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VOL. XIV. NEW YORK, AUG. 3, 1889. No. 5.

The Electric Light Convention. THE various items of news in our columns this week relative to the Niagara Falls meeting of the National Electric Light Association show that it will be a most important and enjoyable convention. The papers and discussions will interest everybody, and all should make a point of being present.

Government Telegraph Rates. DR. NORVIN GREEN has sent Postmaster-General Wanamaker a sharp letter on the subject of the reduced government telegraph rates, and it cannot be denied that he makes out a good case against the absurd new tariff of one mill per word. The government has evidently had the best of the bargain since 1866, and so far from the Western Union Company deriving any special benefit from the act of that year, it has had more trouble and delay in procuring the right to put up poles across government land than if the land had belonged to private parties. One is still at a loss to explain the action of Mr. Wanamaker. Can it be that Mr. Gould's "fat" could not be "fried" out of him in large enough quantities last year, and hence he is made to stand and deliver now?

Dilatory Inventors. A RECENT decision of the Commissioner of Patents, which we print on another page, again calls attention to the danger which inventors incur by failing to reduce their inventions to practice within a reasonable time. The decision emphasizes the point that it is of no avail to clamor for rights in an invention made by another, on the ground of previous work in the same line which had been abandoned prior to the application for the patent by the successful inventor. Due diligence in prosecuting an invention must therefore be observed if annoying consequences are to be avoided. This is especially of importance in electrical work, where the active minds of many are frequently bent on the same subject, and in consequence of which delay may mean considerable loss.

Lighting the "Puritan." EXTENDED and luxurious travel by water is peculiarly an American institution, and perhaps it has its most perfect exemplification in the boats of the Old Colony line between New York and Fall River. At any rate, we know of no finer steamer than the "Puritan," a boat that is in direct line of descent and evolution from Cleopatra's barge, and we think that all who have voyaged by her through the Long Island Sound will yield her the palm for every quality of beauty, luxury, comfort and seaworthiness. The article that we publish this week on the decorative use of the electric light on board the "Puritan" will convey to those who have not seen the vessel some idea of her superb electrical equipment, which reflects so much credit upon all concerned, and it will no doubt offer many suggestions as to the novel methods in which the incandescent lamp may be employed, like colors and flowers, to satisfy the craving for more brilliant æsthetic effects than have ever been attained before.

Resistance of the Human Body. ALTHOUGH the electrical execution investigation brought out nothing startlingly new last week, it nevertheless has stimulated investigation, which we hope will prove of some use in the more useful application to medical electricity. The fact was long ago established that the resistance of the human body is variable under different conditions, but we were hardly prepared to see the interesting results obtained at the Edison laboratory, and given by Mr. Kennelly in another column. These would seem to show that, as a matter of fact, considerable uniformity exists in this matter. The actual measurement of over 200 persons of all sizes and ages showed the resistance from hand to hand to vary very little from the remarkably low value of 1,000 ohms. Naturally, the nature of the contact must be looked to to account for this; but, as Mr. Kennelly points out, it goes to prove that, far from being an uncertain quantity, the resistance of the human body is one which can be stated with considerable accuracy.

The St. John Electrical Exhibition. As will be seen from the special correspondence which we print on another page, the electrical exhibition now being held at St. John, New Brunswick, is a distinct success. It is believed to be the first electrical exhibition ever held in a British colony, and it is certainly far more representative and comprehensive than one would expect. There can be but one outcome to such a display, and that is a great stimulus to the use of electrical appliances throughout the Maritime Provinces and the eastern part of the Dominion generally. In all probability one direct result will be the introduction of the incandescent light on a large scale, but other developments will also take place, bringing New Brunswick fully abreast of Maine, for example, in the electric arts. One pleasing feature of the exhibition is the prominence of American manufactures. With a market so convenient, no great trouble should be experienced in working up a good trade there, and even in using St. John, through its new connection with the Canadian Pacific Railway, for reaching territory beyond the seashore. Be this as it may, the citizens of St. John are to be congratulated upon their enterprise and desire to be abreast of the age, as evidenced in this electrical exhibition, which is perhaps the best proof they could have given that they are fully equal to the grander opportunities that the railway and telegraph have now afforded them.

Popularizing Electrical Information. THE quickness of American journalists and magazinists to appreciate the thirst on the part of the public for information with respect to electrical topics, is seen in the prominence now being given to electricity in various leading publications. In *Scribner's Magazine* for August is an excellent article by President Morton, of Stevens, on the electric light, detailing its evolution as an art and industry; and *Harper's Weekly* of July 27 has a most interesting illustrated description by Dr. Schuyler S. Wheeler, expert of the Board of Electrical Control, of electric lighting in New York. With regard to the latter article, it may be noted that Dr. Wheeler credits New York with 150,000 incandescent lamps, and 7,500 arcs, and his figures are, we believe, remarkably exact and accurate. Such a showing is creditable to New York, and we could only wish that it might be matched by electric railway statistics. It seems to us, moreover, very fortunate that the popularizing of electrical knowledge falls to such men as these. If Dr. Wheeler is so inclined, by the way, he can undoubtedly flatter himself on the fact that he is the most widely read writer on electricity in the English language. His last article in *Harper's Weekly*, it will be remembered, was reprinted bodily in the widely circulating *Illustrated London News* and also in a religious paper of widest circulation in this country. It is in this way that electrical ideas and tastes are made to permeate the public mind, and the work is one that cannot be too well done.

Electrical Execution. THE interest which has been aroused on the subject of electrical execution, and death from the electric current in particular, seems hardly warranted by the little light which was thrown on the question by the majority of the witnesses examined. Lawyer Cockran, being bent on proving the unreliability of the current for the purpose in hand, has naturally framed his questions accordingly, and in but few instances did he fail to gain his point. Looked at from a legal standpoint, therefore, the investigation may possibly bear out the good result of rendering the new law nugatory, as contrary to the Constitution, but, as a scientific inquiry it has failed, with one or two exceptions, to bring out a single fact which was not well known long ago to those who are familiar with the pathological effects of the current. But the investigation brought out one strange fact during the course of Com. Gerry's testimony, in relation to the manner in which electricity came to be selected in preference to three other methods, submitted for approval to a large number of physicians, lawyers, and electricians. Although hanging had the largest number of advocates, we are told rather coolly, that execution by means of prussic acid was discarded because probably no physician capable of administering it properly could be found to undertake the task. And, again, the use of morphine was thrown out because of the prejudice which it might create in the minds of the public against this otherwise useful drug. This is an astonishing admission, and leads us to inquire whether the commission never looked upon the employment of electricity for this purpose in the same light. Surely it could not have escaped them that the wide and constantly increasing application of the electric current for all purposes made it fit to rank, at least in usefulness to mankind, with morphine, which can be replaced by a dozen other narcotics. Again, it does not appear that, among those whose opinion was sought in the matter, there was a very large proportion of electricians. We are free to say that had the opinions of electricians as a body been consulted, the majority against its use for such a purpose would have been overwhelming. Unlike the physicians, in the case of morphine, we do not anticipate any evil as the result of prejudice, should the electrical method finally be adopted, but we protest against its employment, as an unnecessary and ignoble application of a universally useful agent, just as we should protest against a similar use of the steam engine.

Electric Railways for Boston. A striking proof of the favor with which electric locomotion is regarded in Boston is to be found in the unanimous vote of the shareholders of the West End Railway of that city to increase the capital stock by $4,500,000 in order to introduce and perfect the electric overhead system on their various lines. This action is more important and momentous in its consequences than almost any other of late years in the exploitation of electrical improvements. We cannot adequately express our pleasure at this new departure but may at least felicitate ourselves that as far back as some eighteen months ago we were able to urge upon Mr. Whitney the adoption of electricity for Boston, assuring him that the results already obtained elsewhere would guarantee success for that city. Mr. Whitney now confirms the optimistic views generally entertained by electricians on the subject by most remarkable statistics. In the first place he showed that the electric cars already running have for months been making one-eighth faster time than the trains on the New York elevated roads, yet the people do not have any long flights of stairs to climb up and tumble down. Then Mr. Whitney reports that the Arlington electric line, in 17 days, has shown an increase in travel of 150 per cent. That this is not a mere spurt is shown by the fact that, on the Cambridge electric branch running since Feb. 16, the regular steady travel has increased absolutely more than double 150 per cent. since its opening. On the Brighton line also, the receipts for June, this year, are double what they were in June, 1888. The increase with the horse service has been 10 per cent. annually. As to the talk one hears sometimes about depreciation of electrical apparatus, Mr. Whitney offsets it by stating that the West End Railway has to charge no less than $150,000 a year for depreciation in horses. Mr. Whitney further states that the cost of motive power with horses has been 10.16 cents per mile, whereas on the Allston electric line, under many disadvantages, the cost of electric power is only 1¼ cents for fuel and 2½ cents for care of motors, line wire, etc., making a saving on power of at least five cents per mile. Besides, as Mr. Whitney admits, there is a further saving not yet worked out, but by no means small, in the acceleration of speed. In view of all this, we need not wonder to hear Mr. Whitney report: "I am happy to say that since these roads have been put into operation, they have not only met the highest expectations of the company, but they have more than fulfilled the hopes of the community. For full testimony on that fact I refer to every single, unprejudiced citizen of Cambridge, Brookline and Boston, who has had occasion to use the cars and witness the operation of the road." These are still early days in electric street railway work, but no one can question the future when at the very outset such golden opinions can be won. With Boston thus leading the way so magnificently, other cities of equal size and larger cannot long hold back.

NEW BOOKS.

Incandescent Wiring Handbook. By F. B. Badt, Chicago, Ill. Electrician Publishing Co., 1889. 66 pp., 4 × 6 inches. Price, $1.00.

There is so little matter in book form relating to the subject of electric wiring that the appearance of this modest work will be welcomed by many who have heretofore labored in the dark on many of the questions of vital importance in the proper running of incandescent light wires.

The author begins by a short introductory chapter, in which, after mentioning the multiple arc, multiple series, three-wire, and the alternating systems, he states that the only reliable methods which may be used for residences,

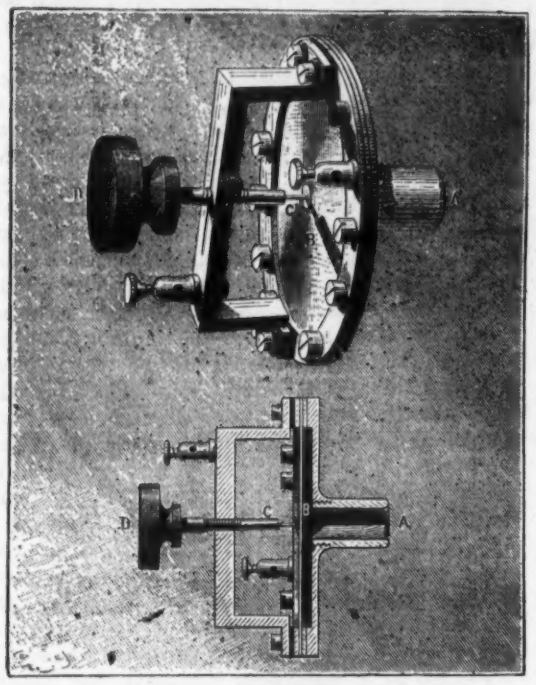


Fig. 2.—Electric Trumpet at the Paris Exposition—Transmitter.

factories and buildings are the multiple arc and the three-wire systems. He then enters into the methods of running wires, describing cleat work and concealed work, both when the building is in the course of construction and when wires are to be run in a building already completed. The interesting question of the location of safety devices and switches is also well explained and methods of splicing and the testing for faults, together with other safety rules, are given. Two short chapters are then devoted to the wiring of fixtures and of elevators.

Probably the chapters which will most interest those engaged in this kind of work are those devoted to the calculation of the drop in potential, rules for determining the size of wires and their safe carrying capacity, all of which are clearly explained. To these there have been added three diagrams for determining directly the sizes of wires for a varying number of lamps at different distances and calculated on a basis of 55, 75 and 110 volts at varying drop in pressure. This will be very convenient for those who are unable to cope even with simple mathematical formulæ.

The Electric Trumpets at the Paris Exposition.

Although the novelties in the department of telephony are not very numerous at the Paris Exposition, there is one telephonic exhibit which attracts universal attention, being a repetition of an experiment performed for the first time in Paris in 1881. This exhibit is made by the Société Generale des Telephones, in the special pavilion of the society, near the Eiffel Tower. The exhibit to which we refer consists of a number of trumpets which are operated telephonically through the medium of the human voice. The manner in which this is accomplished is shown in the accompanying illustration, Fig. 1, taken from *La Nature*, which shows four musicians taking part in the performance.

The system consists essentially of two parts, the transmitters and the receivers. The transmitters operated by the musicians are four in number. Fig. 2 shows the transmitter in perspective and in cross section, and it will be noted that it is quite similar to the one made use of in the curious experiment of the singing condenser. The musician trills his part in front of the mouth-piece *A*, as if playing on the mouth organ. This causes the vibration of the plate *B* in unison with the sound emitted, which in turn produces corresponding periodic interruptions between the disc *B* and the point *C*. The button *D* serves to regulate the distance so that the makes and breaks may be quite free and produce pure sounds in the receiver. In these sounds the overtones are suppressed so that the fundamental tone comes out very strong.

This make and break transmitter is included in the circuit of a storage battery, together with five receivers, which work in such a manner that the four transmitters and the twenty receivers form in reality four distinct groups, the harmony between which is absolutely dependent upon that of the artist operating each group.

The twenty receivers are arranged above the entrance of the telephone pavilion, as shown in Fig. 3. Each of these receivers consists of a U-shaped magnet carrying between its legs two small iron cores with a few millimetres space between them. This is illustrated in Fig. 4, which shows a perspective and a sectional view of the receiver. These soft iron cores each carry a coil of wire *N*, and in the free space between the cores is situated another piece of soft iron *t*, fixed to a vibrating deal board *L*, about ten centimetres square. The periodic interruption of the circuit produced by the transmitter causes a change in the magnetization of the cores of the five receivers, which again causes the energetic vibration of the diaphragm. These vibrations are gathered and directed outward by large brass trumpets connected at *T* to the front of each receiver, as shown in Figs. 3 and 4.

The installation arouses a great deal of curiosity, and is an excellent exhibition of the multiplication of effects possible by means of the telephone.

Variable Resistance of the Human Body.

BY ROBT. H. ENGLE.

Several years ago, long before the question of execution had become one of such importance in the punishment of criminals, I made various tests of the electrical resistance of the human body upon numerous persons, mostly adults, and kept a record of them. For this purpose I ordinarily employed a battery composed of 100 cells, joined in series, having a total E. M. F. of about 100 volts, arranged with a shunt-box to cut down the current at pleasure to suit the resistances to be measured, as I had at that time many high resistances to measure in the form of insulations. All of my tests, without exception, were made with a Wheatstone bridge and reflecting galvanometer. To each binding post of the bridge terminals, between which the unknown resistance was to be found, I attached a standard copper conductor, to each end of which was soldered a piece of 1-inch copper tubing to serve as electrodes.

My first test was the resistance of a young man with an unusually dry skin, and it began with a current due to 10 volts. Grasping loosely an electrode in both hands, which, though dry, were by no means hard or calloused, his resistance from hand to hand was found to be 23,697 ohms. With a tighter grip the resistance fell to 19,502 ohms. Still keeping them in his hands the natural moisture rapidly brought the resistance down to 6,793 ohms. Withdrawing the plugs in the rheostat as rapidly as possible, I was at no time able to obtain a steady deflection of the galvanometer, thus showing the continual change of resistance with the change of other conditions. After soaking his hands thoroughly and moistening the electrodes with water, he again grasped them as tightly as possible, and, without altering the E. M. F. of the battery, another test was made, resulting in a farther decrease of the resistance to 6,237 ohms. Removing the plug from the shunt box, passed the full current of 100 volts through him, and found another decrease to 5,462 ohms. This accords with the experiments of Mr. F. L. Pope, who gave them in his testimony before Referee Becker, in New York, recently, wherein he shows, as I have shown, that the resistance of the human body decreases with an increase of E. M. F.

The resistance of metals and other inorganic substances may be determined with sufficient exactness, making corrections for temperature and other known conditions, but in a living organism, where the external and internal conditions are continually changing, there is barely a possibility that there ever will be a constant resistance.

Regarding the question, "Is electrical execution a cruel and unusual form of punishment?" I would venture the

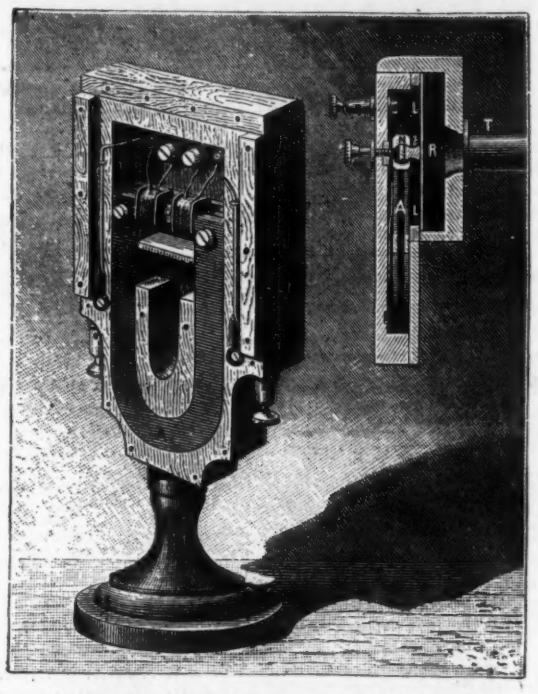
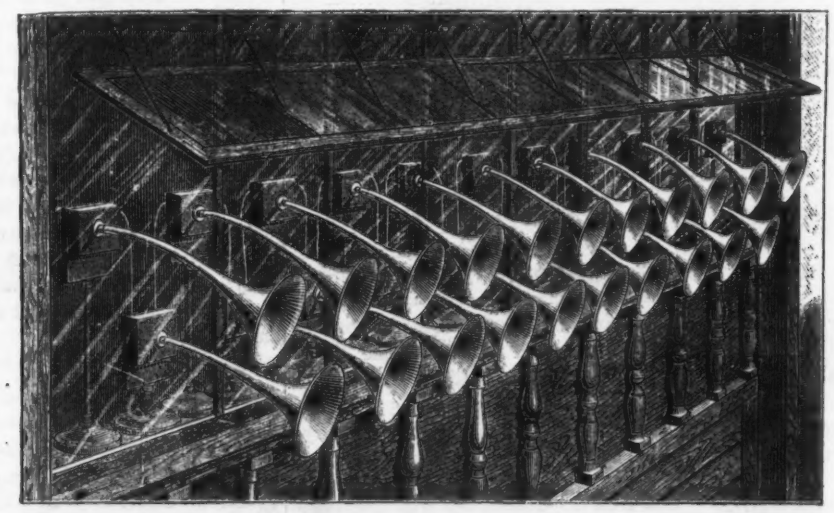


Fig. 4.—Electric Trumpet at the Paris Exposition—Receiver.

suggestion that it is an unusual form, and unless properly applied it might be made not only a very painful but an exceedingly cruel death.

Nearly every case on record of accidental killing by electricity shows it to be attended by severe burns, and a post-mortem discloses clotted blood, which is quite frequently charred or partially carbonized by the passage of the current, which would suggest intense agony in the event of death not ensuing instantaneously. This burning property of the current, as is well known, is due to an excess of current. With static electricity, or even with a continuous or alternating current of high E. M. F. and of small current strength, the effect, it would reasonably appear, would be quite different. This I have, in fact, deduced from experiments made upon small animals, during which I have observed the killing of a cat by a two-light Brush machine, and notwithstanding that the hair was removed and the connection was tight to the skin, from the neck to the hind leg, and moistened in addition, to give it better contact, the suffering and writhing of the animal for nearly thirty seconds was horrible in the extreme. Due allowance must, however, be made for its nine lives. Upon dissection it was found that the muscles were perfectly rigid, the blood dark-colored, and, adjacent to where the wires were attached, apparently charred, as was also the skin.

I have more frequently experimented upon rats and mice with a secondary current from a Ruhmkorff coil giving a spark of ½ inch, and in every case death has resulted instantaneously, apparently without pain, and entirely devoid of the effects displayed in the foregoing experiment. Here it is apparent that the nerve centres become paralyzed by the pulsations of the high tension current, and that to produce an instant and painless death it requires the intense, penetrative, and not the calorific effects of the current.



FIGS. 1 AND 3.—THE ELECTRIC TRUMPETS AT THE PARIS EXPOSITION.

The Decorative Features of the Electric Light on Board the "Puritan."

That the electric light has special and peculiar recommendations on shipboard is now universally recognized, with the result that to-day no man-of-war or even third-rate steamer in the mercantile marine is sent to sea without an electrical plant. It is, however, to such floating palaces as the new boat of the Old Colony line, the "Puritan," that we must look for the most striking and perfect exemplification of what can be done with the incandescent lamp in the service of beauty and the promotion of comfort and safety in this department of lighting. The conditions that have to be dealt with on board a craft of that nature are most various and exacting, and failure in any single respect might quickly prove disastrous to the installation as a whole. Everything is on a huge scale. Steamboats like the "Pilgrim" and the "Puritan" are not only big hotels and restaurants, but they are aggregations of mechanism and appliances that must be constantly inspected or watched; and the additional fact that their runs are always made between dark and dawn, emphasizes the necessity for the most superior lighting that can possibly be secured. In other words, these boats are the finest of their class ever built, and their means of illumination must correspond in fitness and completeness.

When the Edison plant was put on the "Pilgrim," about six years ago, and was described by us at the time, one of the startling innovations was the use of the incandescents for every purpose. This was considered risky by some, but the service at once proved thoroughly trustworthy, as might have been expected, and now the noble "Puritan" is similarly equipped, every gleam of light on her proceeding from the tiny little horseshoe filaments, not merely between decks, but in her signal and steering lamps. In fact, it is not this feature that now commands or deserves attention. Satisfied that the incandescent lamp is what they want, the managers of the line have gone further, and allowed the contracting company to show how admirable is the adaptation of the incandescent light to the most advanced and exacting ideas of decoration. The result is that the long evolution from the primitive clay lamp for oil, through candlesticks and candelabra, down to the modern electric fixture, lending itself readily to each novel and tasteful conception of the artist, has received on the "Puritan" the most beautiful and perfect demonstration that has ever been seen. The drawings that accompany this article are evidences of the grace and skill that characterize the work throughout, and that show how high is the standard attained by the designers and craftsmen in metal used for electric lighting.

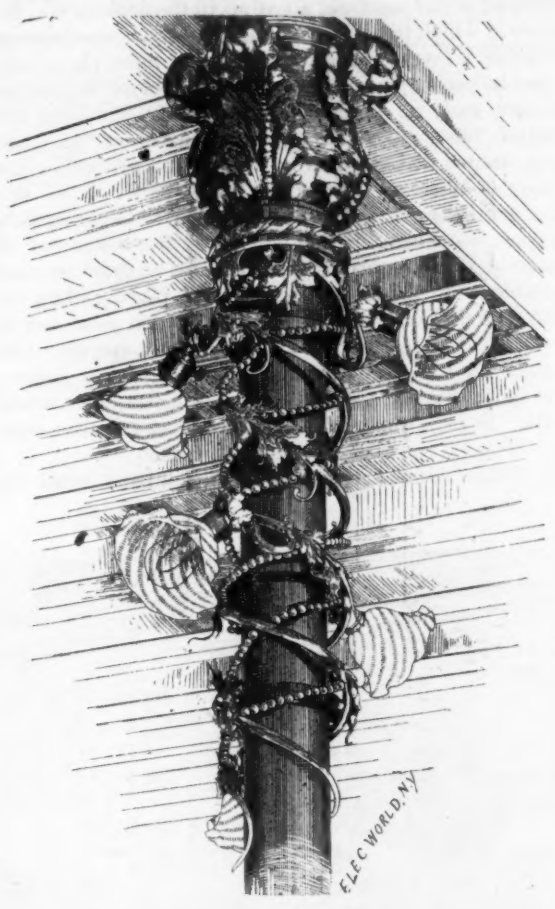


FIG. 1.—FIXTURE ON QUARTER DECK PILLARS, "PURITAN."

The contract for the work in question was awarded by the Old Colony Steamboat Company to Bergmann & Co., of this city, who have met the requirements in a most satisfactory manner. We shall have occasion to speak of the dynamo and electrical details later, but may now point out that the concern above named had not only to supply appropriate fixtures for the various large spaces, but to equip no fewer than 364 staterooms, in some of which the appointments are most ornate. This alone was no mean undertaking, but the artistic taste and technique of the designers found its gravest problems to be solved in the grand saloon, the social hall, the dining room, and on the quarter-deck. The general scheme of decoration on the "Puritan" was elaborated and carried out by Mr. F. H. Smith, and is in the style of the Italian Renaissance. Its exquisite grace and airy charm of treatment are a delightful surprise after the massive and clumsy splendor that distinguishes the decorations of so many other boats; and the eye finds rest and relief in the subdued tints and tender tones, accentuated here and there by gilt or dashes of brighter color, and strengthened by the simple wrought iron work. To produce "electroliers" that should harmonize with this delicate though masterly style of decoration was no mean task, yet it will be admitted that success has been reached very happily, and that the distribution of the light is also most effective.

On the quarter-deck the illumination is mainly obtained from six beautiful vine fixtures placed around the small masts, and each carrying five lights. These vines, shown in Fig. 1, are of lacquered bronze. In the social hall adjoining are seen other elegant brackets and electroliers to match the carpets and paneling, and in the dining-room some very ingenious work has been done in running the lamps, backed by reflectors, centrally, in tiers, along an I-beam, so that the light, shed through rolled opalescent glass, made in sections two or three feet long, is equally and softly diffused in every direction. But it is in the grand saloon, naturally, that the best and most brilliant effects are obtained, and that the adaptability of the electric light to decorative effects shows itself most perfectly.

Our illustration, Fig. 2, gives an admirable idea of the manner in which the grand saloon is lighted. The old, cumbrous chandeliers that dance and jingle, and shake and jar at every throb of the engines, are gone. In their place one sees twining upward around the huge white masts,

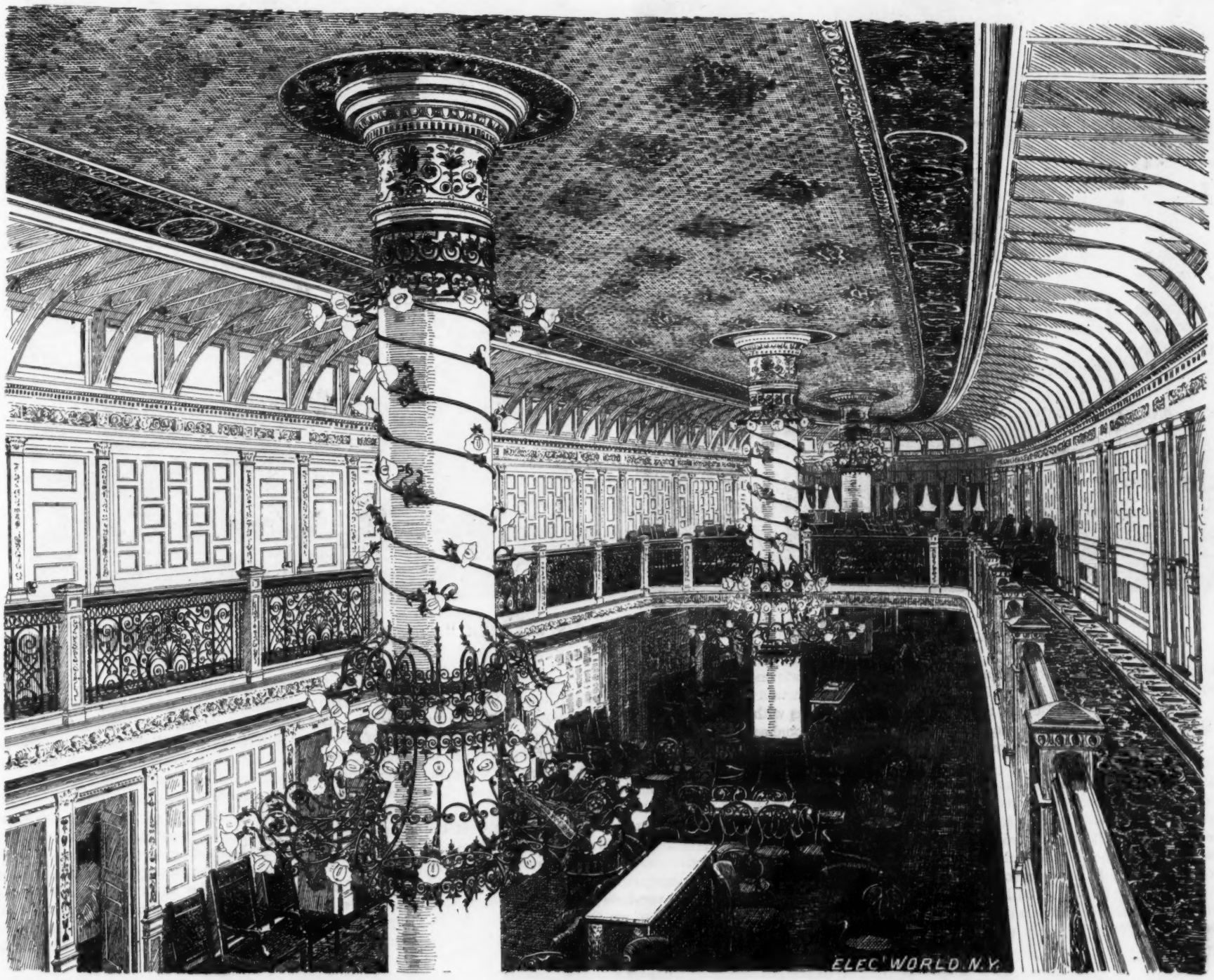


FIG. 2.—DECORATIVE FIXTURES OF BERGMANN & CO., ON GRAND SALOON MASTS, "PURITAN."

beautiful ivy vines in wrought iron, from behind whose leaves and tendrils the lamps spring. At the top the vine gathers itself into a coronal and at the bottom it broadens out into luxuriant, conventionalized wreaths; and the effect of the whole is simply magnificent when the current is turned on and the mellow light of the lamps contrasts with the pearly whiteness of the masts and the sombre gleams of the metal work. These mast fixtures, from which all the light is derived, are 2 feet 6 inches in diameter, and the top is 2 feet from the ceiling, while the bottom is some 7 feet from the ground. Each fixture carries 76 lamps of 16 c. p. It will be noted on close examination that they were hammered by hand. The art superintendent, Mr. Smith, would not be satisfied with cast metal, and it was difficult to get the hammered work done in time, but Bergmann & Co. were not daunted, and the result is extremely creditable to them. The peculiar effect of color on the fixtures, giving them exactly the appearance of fine old Japanese bronze, was obtained by heavily copper-plating them, after which they were oxidized, then blackened with turpentine smoke, then lacquered and finally varnished. With regard to the hammer work, it may be mentioned that it was all done by German workmen at Bergmann & Co.'s factory, and that it involves the most skillful handling, each delicate leaf and vine receiving innumerable taps before it is molded into the required shape and comeliness.

By removing a few screws in the band around the mast, the connections for the groups of lights can be seen and got at. There is a concealed safety catch for every three lights, and at the base of the hollow masts are the switches for the whole of each wreath, the switches being reached by moving one of the chairs. In this connection it may be noted that a large, handsome fixture of 36 lights, Fig. 4, in this style of Japanese bronze, illuminates the forward cabin. It is usual to put the safety catches up under the canopy on the ceiling. In this case they are placed in the base, where they can very easily be reached if occasion should arise.

There are many other details of decorative illumination, but it would take a volume to enumerate them all. Mention may be made, however, of the beautiful dolphins in Bonnard bronze placed on the newel posts at the foot of the gallery stairs in the main saloon, as illustrated in Fig. 3. Another special feature consists in the lights along the corridors on the saloon deck, these lights, in opalescent glass shades, being so arranged that by means of the key at the bottom, one, two or three lamps can be burned in each at will.

After what has been said above about the fixtures and the manner in which they subserve and round out the scheme of decoration, a few words as to the electric light plant itself will not be out of place. When the Old Colony Steamboat Company took up the matter of electric light for the "Puritan," they placed the matter in charge of Mr. Chas. Pierce, the son of Capt. Pierce, who is the supervisor and manager of the line. Young Mr. Pierce took hold of this matter energetically, and, although not considering himself an expert electrician in any way, with the assistance of disinterested parties in electrical business he drew up most admirable specifications for the proposed plant, calling for the highest class of work which has ever been presented to the electrical companies to bid on. These specifications embodied all the good features called for in the government specifications, and in general respects were equal thereto. In fact, much of the work called for was what has been styled regular "government work."

The Edison United Manufacturing Company were the fortunate ones to secure the contract, and Mr. Chas. A. Benton was the agent who represented them in their negotiations with the Old Colony Line. The contract also had the additional security of having the indorsement of the Edison Electric Light Company and the general supervision of Mr. E. H. Johnson, who was then president of the company. The plans were laid out by Mr. C. J. Field. The plant as arranged for is intended to do away with all old style arrangements that are out of date at this stage of the industry. The plant is laid out for direct shaft connection, one engine being connected to two dynamos. There are two double Armington & Sims' horizontal engines, with cylinders eight inches in diameter and seven-inch stroke, to run at a speed of 450 revolutions, and of about 80-horse power capacity each. Each engine is connected to the same bed plate from a Hill friction clutch by two compound wound automatic Edison dynamos, with a capacity of 400 lights, and an output of 200 ampères at 120 volts for each machine. The armatures in these machines are of a special Gramme ring type. The machines are specially designed for lightness of weight and efficiency for this speed, and tests on the regulation have given results which show no variation in the electromotive force at the lamps, with any change of load.

The plant is located in the forward hold and is arranged in a remarkably convenient manner for handling. On the switch board are located the circuits which go from the dynamo room, which are 7 in number, and ampère meters and volt meters. Siemens Bros.' ampère meters and the Cardew volt meters are used.

The plant, whose arrangement is shown in Fig. 5, was equipped with everything in the most complete manner, and all spare parts and supplies were furnished to enable the ship to be practically independent and entirely reliable against any possibility of a break-down, as she depends entirely upon the incandescent lighting for illumination. This plant gives the vessel an electrical capacity of 1,600 lights, and there are about that number distributed all over the boat. At most times, though, one engine and two dynamos are sufficient to carry the lights that are on at any one time, and thus they have half the current capacity in reserve.

The specifications called for the very highest grade of work in the wiring. Habirshaw marine grade was used, the same as is used on the naval vessels, and where located in any exposed position, it was lead-covered. All cut-outs and switches were the Edison type of porcelain manufacture, and were mounted on porcelain bases, and all sockets were made fire-proof and non-combustible. In all exposed positions the water-tight junction-box has been used for cut-outs. The circuits are so run and arranged that no one part of the vessel will be without light due to any circuit breaking down or for any other cause. All this work was done under the careful personal direction of Mr. Pierce.

FIG. 3.—THE STAIRWAY, GRAND SALOON, STEAMER "PURITAN."

Every endeavor has been made by the different gentlemen interested in the equipment of this plant, to make it as complete and perfect as possible. It stands to-day a credit to electrical and engineering science, and shows what can be done under liberal management on both sides.

Some idea of the extent of the work done will be formed when we state that the electric light circuits reach a total length of 12 miles, and that with the annunciator, fire-alarm service, etc., added, there are 20 miles of circuit. The stately "Puritan," as she makes her way through the Sound, night after night, gleaming with incandescent lights from stem to stern, tier above tier, is as perfect an exemplification as one could find of the pitch to which utility and beauty have been brought in the electric arts.

We think that Bergmann & Co. may justly take pride in the brilliant and tasteful display that they have made, and that our article is intended to bring out. After all, it is mainly by the "effect" produced that the public judges, and we may safely say that a more striking result

in the decorative use of the light has never been attained. We would suggest that, as a means of getting a good idea of the wonderful advance made in "electrolier" work, by Bergmann & Co., one should go on board the "Pilgrim" immediately after leaving the "Puritan." The "Pilgrim" even to-day is in her electrical decorations a model and example, but the novel and special features on the "Puritan" so far surpass them that it is impossible to compare the two on the same plane. On the "Puritan," the use of the lamps escapes altogether from the suggestion of gas and gas fixtures. There is a freedom and graceful luxuriance about the different arrangements and devices that brings out in an incomparable way the ease with which the incandescent light lends itself to schemes of decoration and invites to new methods of adornment. The impression thus produced on the public mind by the excellent designs and fine work of Bergmann & Co. must, we are convinced, do much to promote the introduction of the light everywhere. Our thanks are due to Messrs. Insull, Hutchinson and Robb, of Bergmann & Co., for the information furnished.

An Important Patent Decision.

The Commissioner of Patents has just rendered a decision in a case which, although not directly relating to an electrical invention, will, nevertheless, be of interest to electrical inventors.

In the case of the Fowler Cast Steel Car Wheel Company, of Chicago, and the Pittsburgh Steel Casting Company, of Pittsburgh, the Commissioner has decided in favor of Fowler, the patentee, thereby affirming the decision of the Board of Examiners-in-Chief and the Examiner of Interferences. The Commissioner in his decision says:

"It will be observed that an interval of nearly four years elapsed between the abandonment of the method claims of Beach's first application and the filing of the application involved in this interference, and that meanwhile Fowler had conceived the invention in controversy, reduced it to practice, entered upon the use of it in an extensive manner, applied for and obtained a patent, and that nearly a year had elapsed after the patent was published to the world before Beach filed the application now in controversy. That an abandoned application can not of itself constitute a bar to a subsequently granted patent is abundantly established."

Electrical Execution by Means of an Inductorium.

BY EMILE BERLINER.

The question whether a current of electricity can produce instantaneous death in a human being depends on the proportion which the resistance of the body bears to the electromotive force of the current.

It has, however, been sufficiently demonstrated that there exist great differences in the same human body when measured at various times and under varying conditions Hence it follows that a large margin must be provided, for the purpose of securing absolute certainty in dealing out electricity for the purpose of executing criminals.

But such absolute certainty must not be looked for with the electromotive forces as used in ordinary arc light machines, for while it is true that an alternating or arc light current may kill if applied for several minutes, unless sensation is destroyed instantaneously, the death agonies of the victim, even for the term of ten seconds, may be terrible beyond description—however deserved such suffering might be with some criminals.

Persons who have been near death have related how scenes of their whole lifetime passed before them during the few moments of their supreme danger and every one knows that the mind may dream a long story during a few minutes preceding the awakening.

In considering, therefore, the shortest possible method of transporting a criminal from life to death—if it be the aim of the law to make the death penalty as easy as possible—no device should be used in which there is the slightest doubt that insensibility would not be produced instantaneously. Let the voltage, therefore, be so high as to preclude the possibility of failure with the proper application of wet sponges and metal contact plates.

I would propose to accomplish this by interposing an induction coil between the dynamo and the criminal, and to let the alternating current of 1,000 volts be transformed into one of 10,000 volts before reaching the contact sponges. The physiological effect, on which alone success in this case depends, will thereby be so enhanced that paralysis of the brain will be the immediate result.

Nor is it necessary with such an arrangement to use an alternating current. A dynamo supplying a current in one direction for, say, 500 incandescent lamps would be amply sufficient. Before the criminal is seated this current is closed to the primary of the inductorium, the secondaries of which pass to the sponges. When all is ready a toothed contact-wheel rapidly interrupts the primary for a few seconds and the criminal will be dead beyond resuscitation.

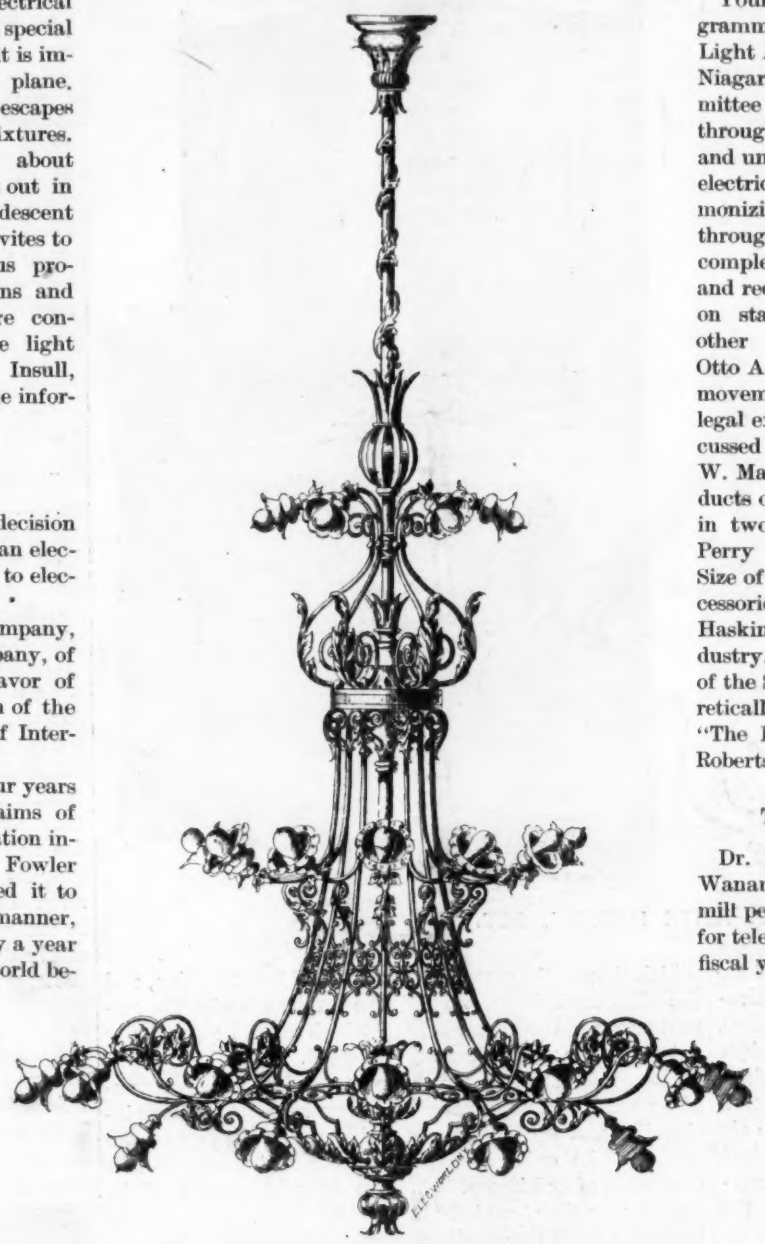


FIG. 4.—ELECTRIC CHANDELIER, FORWARD CABIN, "PURITAN."

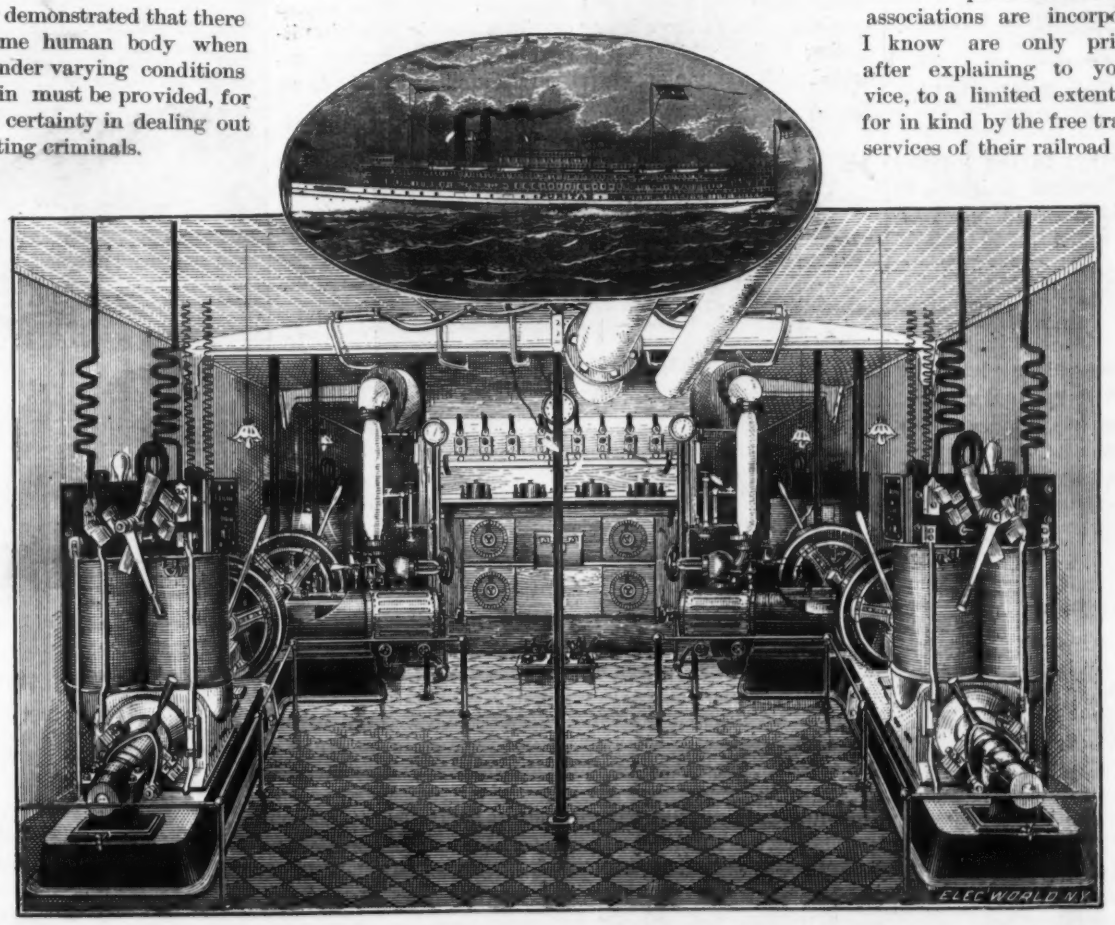


FIG. 5.—EDISON DYNAMOS AND ARMINGTON & SIMS ENGINES ON STEAMER "PURITAN."

King Humbert of Italy has been presented with an Edison honograph, which greatly pleases and amuses him

Programme of the Niagara Falls Electric Light Convention.

Secretary Garratt has issued the following important notice:

Your attention is called to the following partial programme of the tenth convention of the National Electric Light Association, to be held at the International Hotel, Niagara Falls, N. Y., Aug. 6, 7 and 8. The National Committee on State and Municipal Legislation will report through its chairman, Mr. A. R. Foote, on the favorable and unfavorable legislation in this country, touching the electric light and power industry. The Committee on Harmonizing Electric Light and Insurance Interests will report through its chairman, Mr. P. H. Alexander, giving very complete statistics on the fire loss on electric light stations, and recommending measures by which insurance rates on on stations may be lowered. There will be several other committee reports on vital questions. Dr. Otto A. Moses will address the convention on the recent movement to introduce the use of electricity as a means of legal execution. Some of the papers to be read and discussed are as follows: "Electric Street Railways," by George W. Mansfield; "Methods of Arriving at the Cost of the Products of a Station," by A. J. De Camp; "An Ideal Station," in two parts, Mechanical and Electrical, by Marsden J. Perry and John T. Henthorn; "The Economic Size of Line Wire," by Benjamin H. Rhodes; "Station Accessories in the shape of Measuring Instruments," by C. C. Haskins; "The Value of Economic Data to the Electric Industry," by A. R. Foote; "The Development and Progress of the Storage Battery," by William Bracken; "The Theoretically Perfect Arc Light Station," by M. D. Law, and "The Electrical Transmission of Power," by Prof. E. P. Roberts.

The Reduced Government Telegraph Rates.

Dr. Norvin Green has written to Postmaster General Wanamaker in regard to the discussion over the rate of 1 mill per word fixed by the Postmaster General as the pay for telegraphic dispatches for the government during the fiscal year beginning July 1. Dr. Green denies emphatically that any information to the press upon the subject came from him. He says that even after Mr. Wanamaker was interviewed and tried to justify his order by pleading that as low a rate was extended to corporations Dr. Green remained silent, although the Postmaster General's statement was untrue. Business considerations now force him to reply. Again denying that any corporation has had as low rates as the government has imposed since July, 1884, Dr. Green says:

"I did not infer that in the language 'various large corporations' you could have referred to the press associations, for very few, if any, of these associations are incorporated, and the larger of them I know are only private associations. Nevertheless, after explaining to you that our so-called free service, to a limited extent for railway companies, was paid for in kind by the free transportation of men and material, services of their railroad operators, and in most instances the furnishing of labor and other assistance in maintaining the lines, I went on to say that our lowest rates should naturally be those for the transmission of news for publication. It is not an exacting service, and it is done mostly at night.

"Except the arrangements with railroad and transportation companies, and rates for press and commercial news service, we make no reduced rates to any corporations or other patrons, large or small. For messages transmitted and delivered to a single address, the government is our only customer that enjoys reduced rates.

"As to the great privileges and benefits derived by this company from the act of 1866, they are purely imaginary. I am not aware that we have ever taken a stone or a stick of timber or appropriated a foot of land belonging to the government under that act; and where we have needed to build a line across lands belonging to the government, as in a late instance across the lands along the canal around the Falls of Ohio, we have had more trouble and delay in procuring the right to set our poles than if the lands had belonged to private parties."

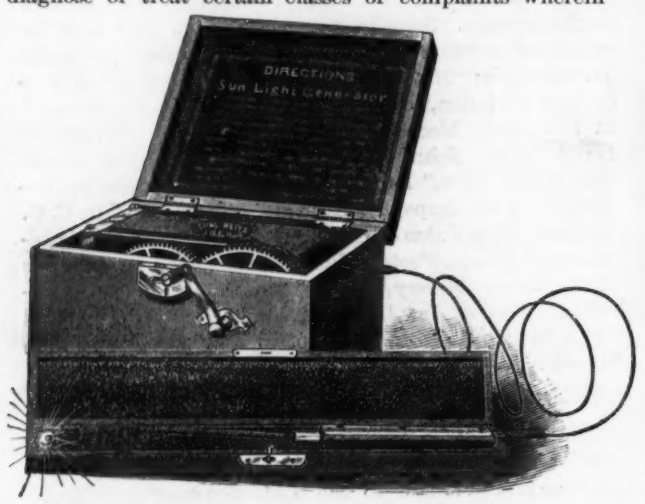
The International Theatre near the foot of the Eiffel Tower, Paris, erected in 35 days at an outlay of $40,000, to hold 2,500 persons, will be opened as soon as the electric lighting arrangements are completed.

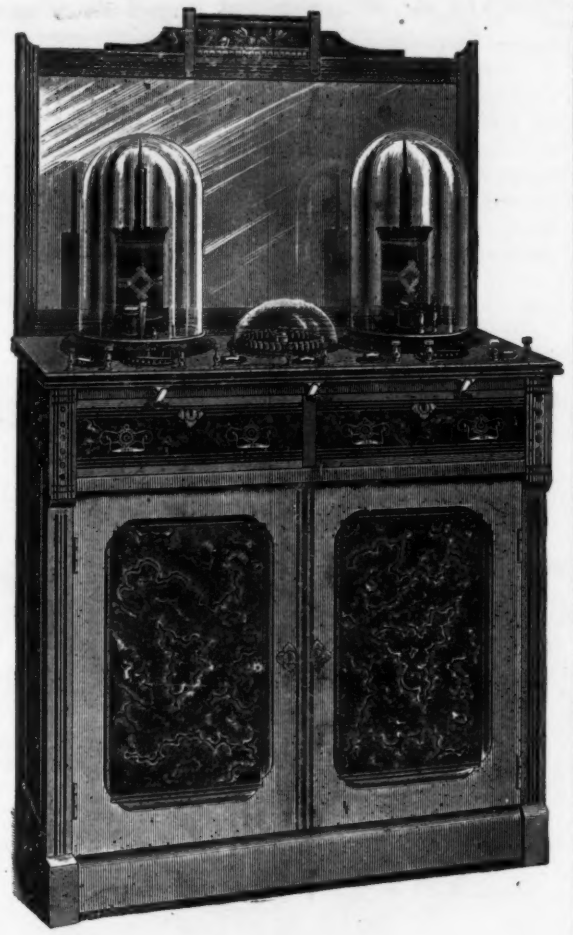
Physicians' Office Batteries.

The great value of electricity in the treatment of certain classes of diseases has long been acknowledged by the most prominent physicians and surgeons, and many practitioners do not consider their office thoroughly furnished until it contains a complete electrical cabinet. A standard office battery of this type is illustrated in the accompanying engraving, Fig. 1.

The battery consists of thirty-six cells of an improved Fuller type, connected to a hard-rubber switch-board, over which the placing of a glass case prevents accumulation of dust; the switch-board is arranged to operate under the glass by means of a crank handle placed on the front edge of the case. The cabinet also contains two electro-magnetic machines, operated by two cells each of the Fuller type, together with the necessary regulating coils, switches, etc. Mr. Charles Reitz, of Indianapolis, Ind., who exhibited the $2,000 medical battery at the Centennial Exposition in Philadelphia, is the manufacturer of these cabinets.

The "Sunlight" generator, also manufactured by Mr. Reitz, and shown in Fig. 2, is an appliance of especial value to physicians who may be called to a patient's residence to diagnose or treat certain classes of complaints wherein





FIGS. 1 AND 2.—REITZ MEDICAL SET.

speedy relief can only be afforded by examination and exploration. The outfit complete consists of a magneto-electric generator having a Siemens armature 3½ × 1½ inches, and the necessary gearing required to revolve the armature with a crank handle. The whole is encased in a neat black walnut box 6 × 7 × 5 inches, while a separate case contains an incandescent lamp, of any desired power up to six candles, well mounted on a flexible rubber handle attached by means of a double plug to a long conducting cord having a duplicate plug at the opposite end. To obtain the benefit of artificial illumination, it is only necessary to attach the loose plug to the generator and revolve the armature by means of the handle. While the principle involved is not new, the application is an excellent one, enabling the physician to instantly secure a clear white light without the disadvantage attending the use of primary or secondary batteries.

Excellent Performance of the Sprague Road at Cleveland, O.

One of the most successful railways in the country operated by electricity is the East Cleveland Railway, of Cleveland, O. This electric railway has now in operation about 17 electric cars on the Sprague system, and has recently ordered a large increase of electrical apparatus, sufficient to operate all its lines by electric power.

In a recently published report a very excellent showing of the operation of electric cars is given, and one which must inevitably increase the sense of reliability which street railway managers feel in their electrical equipments, and must also be very gratifying both to the operating company and to the company which supplied the apparatus.

During the month of May, 1889, this railway had 17 cars on duty. During this time the cars covered the aggregate distance of 45,640 miles, making the average car mileage per day 93.72 miles.

During the month,

2	runs of	193	miles	per day were made.
2	"	190	"	"
1	"	170	"	"
1	"	165	"	"
3	"	159	"	"
4	"	153	"	"
6	"	148	"	"
9	"	142	"	"
31	"	136	"	"
23	"	131	"	"
22	"	125	"	"
1	"	121	"	"
23	"	119	"	"
27	"	114	"	"
37	"	108	"	"
34	"	102	"	"

The maximum run for the month of one car was 3,536.46 miles, or an average per day of 114.08 miles. One car for 8 successive days made an average of over 143 miles.

The duty required of these cars was of the most severe character. There were no reserve cars, and each car was required to do constant service. Each car had to be run at the highest rate of speed. There are two steam railroad crossings on the line of the road.

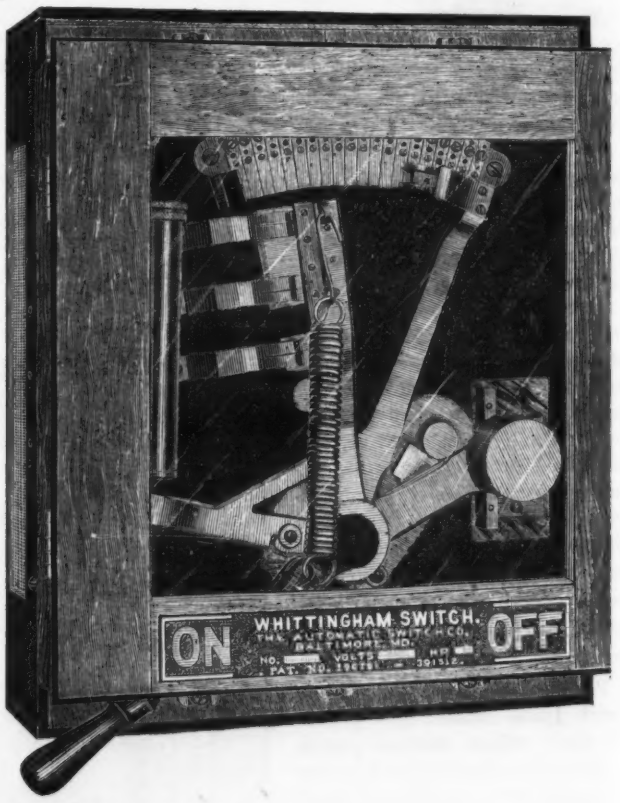
This record is a remarkable one, and reflects credit both on the management of the road and the character of the equipment.

The Whittingham Automatic Switch.

In starting motors on constant potential circuits precautions must be taken to prevent too great a rush of current before the motor has attained its proper speed, and this is usually accomplished by means of two switches, one of which throws the current on the field of the machine, and the other controlling a resistance through which the current passes to the armature, and which must be gradually cut out as the motor increases its speed.

This gradual removal of the resistance is usually performed by hand, and must necessarily require some previous instruction and the exercise of judgment on the part of the operator. In order to avoid this, the Automatic Switch Company, of Baltimore, Md., have brought out the Whittingham switch, which has lately been considerably improved, with the result that no damage can be done to either switch or motor by any movement of the handle of the switch.

The switch which is shown in the engraving, Fig. 1, is composed of two levers and a handle moving on one centre bearing. One of these levers carries a double pole circuit-closing device, which, when operated by the spring connected with the handle, enters the three spring contacts on



FIGS. 1 AND 2.—THE WHITTINGHAM MOTOR SWITCH.

the left of the box. The other, or under lever, is, to a certain extent, under the control of the circuit-closing lever, in that it cannot advance until the circuit-closer has been thrown into its contacts. The movement of this under lever is one of the novel points of this switch, it being moved and governed by the dash-pot connected to one end, the other end terminating in roller contacts, carrying current to the armature through the different graduations of resistance.

As the switch is operated entirely by the spring connected to the handle, it will be seen that both the start and the stop of the switch must be instantaneous, as the spring in most cases passes the centre before acting.

The fuse clamps on the right of the box are under the counterbalance of the circuit-closing lever when the switch is in use, and should the fuse burn, from an overload of the motor, the switch must be returned to the "off" position before the fuse can be replaced; consequently all danger of burned fingers through forgetfulness is avoided.

The switch shown in Fig. 2 is intended for use on motors up to two-horse power and is somewhat different in construction from the one just described, as in it only one lever is used for closing the circuit and cutting out the resistance. This lever is actuated by quick throw springs connected with the handle, and is controlled by a vibrating escapement governor. The shut-down is instantaneous and without spark when the motor is running up to speed.

The switch is so constructed that it is impossible to shut down the motor without throwing the resistance of the box in series with the armature. There is, therefore, no danger of a short circuit through the armature.

As a rule, these switches are so constructed that the governors remove the resistance from the armature circuit in about ten seconds; but, of course, if the motor is on very heavy work, it can be arranged to move more slowly. The switches are particularly adapted for electric elevator and pumping work, as they can shut down or start a motor by means of a rope.

Effect of Electricity on Germination.

In order to study the influence of voltaic electricity, Mr. H. N. Warren placed pads of cotton, saturated with a dilute solution of salt and sown over the surface with common mustard seed, upon platinum plates connected with four constant ferric chloride cells. In less than twenty-four hours germination over the positive plate was distinctly visible, and at the end of a week the growth was upward of an inch in height and of an intense green color. In the same time on the negative plate germination had only commenced and the growth was almost white. On reversing the current the previously flourishing growth became bleached and speedily withered, while the other gradually assumed a green color, flourished for a time, and then also withered. The bleaching of the growth in the neighborhood of the temporarily negative plate is thought to have been due to the small but constant liberation of chlorine, and it seems evident that this factor must be excluded from the experiment before correct conclusions can be drawn as to the relative influence of the positive and the negative current on germination.

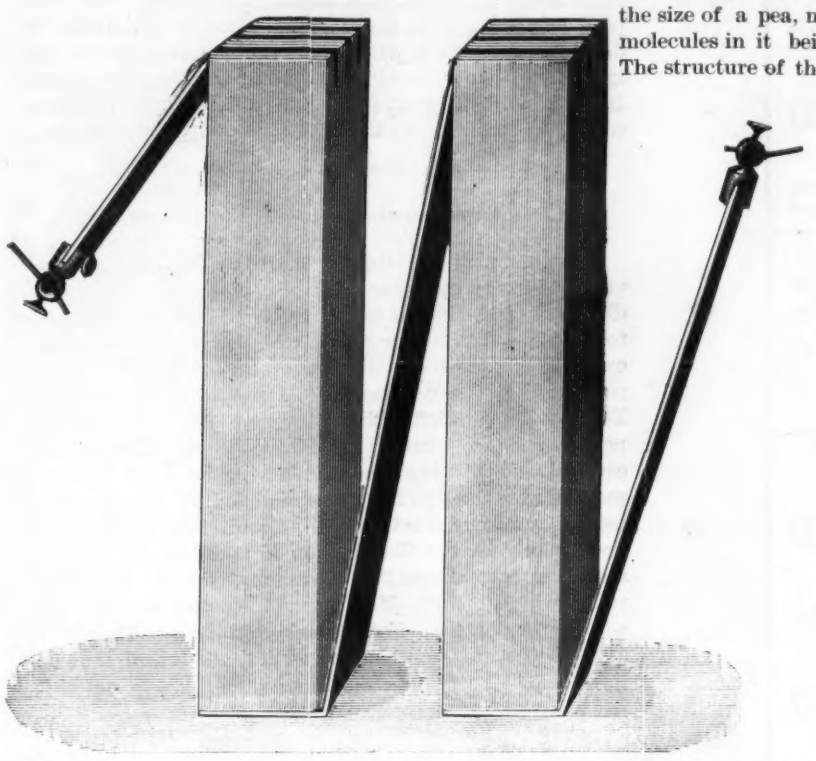
Iron Telegraph-Poles in India.

Iron telegraph-poles and iron fence-posts are used in India on account of the destruction of wood by white ants. The telegraph-poles on many of the lines are hollow tubes of galvanized iron, about as big around as the average man's leg, so made that they fit into one another, and form a pole about ten feet high. To these poles the lines are strung, and many of the roads use such poles throughout their entire length. On other lines the telegraph-poles are T-iron rails, the same as those on which the car travels. Two of these rails are fastened together by bars about one foot wide, and then this iron lattice-work is set deep in the ground and the wire strung upon it. About some of the stations the fences are made of such iron rails, and through hundreds of miles along one of the railroads in western India fences of barbed wire are seen, with sandstone posts. These stones are one foot wide and about four inches thick, and three feet above the ground. The wires run through holes in them, and they are said to be much cheaper than wood.

Thermo-Electricity Theoretically and Practically Considered.—II.

BY ARTHUR RUST.

These experiments are interesting, but we do not understand the reasons of the results yet, and we must do so to guide us into further knowledge. It must be pointed out that unless the connections are in close contact, the resistance is so tremendously increased that for any commercial purpose the system is absolutely valueless. We will, therefore, turn and experiment upon some of the older forms of thermo-couples, and see what can be learned from them.



FIGS. 12 AND 13.—STUDIES IN THERMO-ELECTRICITY.

These form Class 3. Remembering the old rule, that the thermo-electromotive force is proportional to the difference of temperature of the junctions, let us construct some couples, $3\frac{1}{2} \times \frac{1}{2} \times \frac{5}{8}$ inches, by taking 18 gauge sheet iron, and cutting the ends into three slits, which, when twisted and having the zinc-antimony poured in, will form the junctions seen in Fig. 12. Heat up to 375 degrees Fahr., and we have only 33 degrees on the galvanometer. This is clearly going backwards. Now let us try half the length of couple, say $1\frac{3}{4} \times \frac{3}{4} \times \frac{7}{8}$ inches from No. 20 gauge sheet iron (Fig. 13). Connect up, and at the same temperature we have 42 degrees deflection, or a little better than the result of the longer ones, Fig. 12, which is in direct contradiction to the recognized laws on the subject.

Now let us take wire gauze double, instead of No. 20 gauge sheet iron, say about 16 mesh, and construct 2 couples, say, $1\frac{1}{2} \times \frac{5}{8} \times \frac{7}{8}$ inches, Fig. 14. Try them at 410 degrees Fahr., and we get 49 to 50 degrees deflection. This is better. But we will try and get the molecules into a state of still greater friction one with the other. Remembering that the conductivity of iron is 20.18 and Z A 5.5, and that the larger the iron surface-friction against the Z A the greater E. M. F. we might expect to create, let us construct an element $1\frac{3}{4} \times \frac{3}{8} \times \frac{7}{8}$ as the last and with the same materials. Let us insert, upright, into the Z A a number of pieces of this iron wire gauze, alternately 1, and $1\frac{3}{8}$ inches long, connected to the bottom iron (Fig 15). Heat up as before. We look anxiously at the galvanometer. It begins to rise slowly, slowly, slowly, and stops, instead of at 50, at 8 degrees. Why is this? We cannot as yet the reason see! The iron being the best conductor of heat, its molecules should (in Fig. 15), according to the theory advanced, strike the molecules of Z A, and generate a greater E. M. F. as the consequence. How can we get at the truth of this matter with Fig. 15 staring us in the face?

With regard to the molecules of bodies, three different states of aggregation present themselves: First, the solid state; second, the liquid or fluid state; third, the gaseous state. These experiments have only to do with the first or the solid state, although of course, the two latter come into play in many of the other sources of electricity. From considerations based upon various physical phenomena, Sir Wm. Thomson has calculated that, in ordinary solids and liquids, the average distance between contiguous molecules is less than one hundred millionth, but greater than the one two thousand millionth, of a centimetre; and to form an idea of the size of the molecules, Sir W. Thomson gives this illustration: "Imagine a drop of rain, or a glass sphere, the size of a pea, magnified to the size of the earth, the molecules in it being increased in the same proportion. The structure of the mass would then be coarser than that of a heap of fine shot, but probably not so coarse as that of a heap of cricket balls." Professor Tait, when making the same calculation, suggested marbles. The number of molecules in a cubic inch of gas at 0C. temperature and 760 millimetres pressure has been calculated to be about one hundred thousand million million million, or 100,000,000,000,000,000,000,000 (10^{23}). The molecules of a gas are always in a rapid motion. The mean velocity of hydrogen molecules at 0.C. and 760 millimetres is about 6,000 feet, or $1\frac{1}{2}$ miles per second (the length of its path being .0,001,855 millimetres, and nine thousand four hundred and eighty millions (9,480,000,000) for the number of its impacts.

These molecules and atoms are what we are dealing with, and their extreme minuteness it is which makes it so difficult for the mind to conceive them, and to understand in any way the part they play.

We construct four cubes, one each of iron, and Z-A in, $\frac{5}{8}$ inch, and one each in 1-inch cubes. After putting a little wax on the top of each, and placing all at the same time on the heated surface, we find that with the $\frac{5}{8}$-inch cubes the wax on the top of the Z-A melts first; but with the 1-inch cubes the wax on the *iron* melts before the wax on the Z-A.

Now we construct two bars $\frac{1}{4}$-inch square, one of soft iron and one of zinc-antimony, and fix upon each bar peas, by tallow, sealing wax, or any suitable material, $\frac{1}{4}$ inch apart, the bars being held by convenient stands. We light a Bunsen burner to produce the heat, and place it exactly in the centre of the space between the two bars. What are the results? Of course, if we had not tried the cubes' experiment we should have said that the iron, being the better conductor, would take the heat first; but no, to our surprise, the peas on the bar of Z-A fall first, about in this order:

1	2	3	4	5	6	7	8	9	10	11	12	13	14
Z-A	I	Z-A	I	I	I	Z-A	I	I	I	Z-A	I	I	1

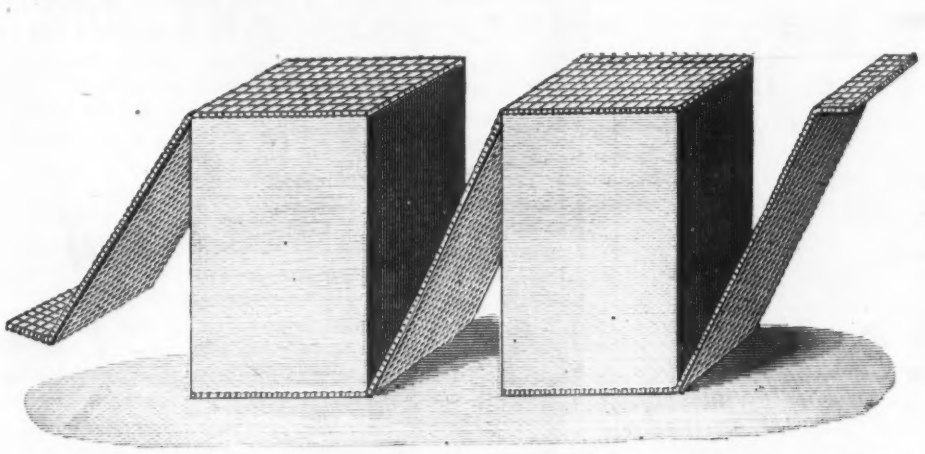
15	16	17	18	19	20	21	22	23	24	25	26	27 to 35
Z-A	I	I	I	I	Z-A	I	I	I	I	Z-A	I	Iron.

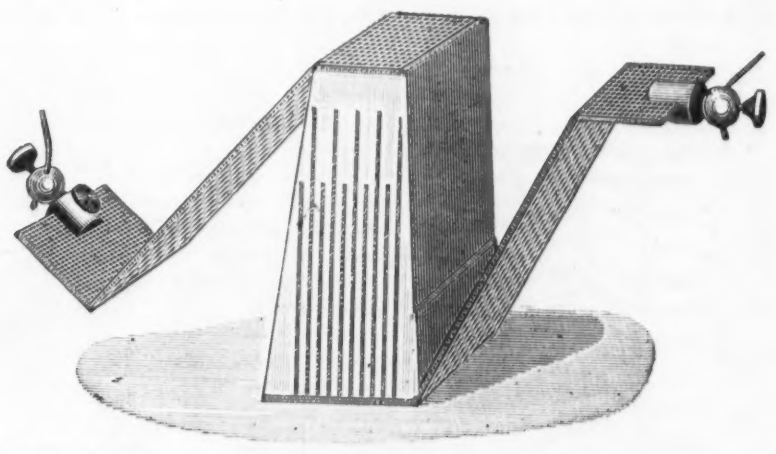
We try this several times, in several ways, with different degrees of heat and different sized bars; also with shot, set $\frac{1}{8}$ inch apart, instead of peas at $\frac{1}{4}$ inch, but *always* with a result closely similar. Singularly enough, we find the heat takes from twice to four times as long to travel to the last pea that falls from the iron bar, as to the last pea that falls from the Z-A bar.

Fig. 17 shows the iron and Z-A bars put side by side, and the proportionate rate the heat travels upon each, as it arrives at *a*, *b*, *c*, *d*, etc., on each of the bars, at about the same time.

Fig. 18 gives a very rough idea of the proportionate stress that the Z-A molecules exercise upon the iron molecules, showing that the first contact of heat is by far the greatest.

Fig. 19 shows two curves representing the rate at which heat travels along the bars of Z-A and iron. But, of course, the rate varies according to the temperature and according to the iron used, whether hard, soft, or annealed.





FIGS. 14 AND 15.—STUDIES IN THERMO-ELECTRICITY.

In these striking facts we think we have light cast upon this subject, and shall find that we have something to work upon. We learn that Z-A, having fewer atoms than iron, the nearest portion of the Z-A bar is heated before a similar portion in the iron bar, although the iron is almost four times a better conductor of heat, So that it is not the molecules of the iron swinging in friction or with vibratory stress against the Z-A that causes the flow of electricity, but it is the molecules of the Z-A swinging in friction or with vibratory stress against the molecules of the iron. This can further be explained. In this combination of Z-A and iron, Z-A receives and loses heat first, and the molecules have taken up their full complement of heat before the iron in the earliest portions of a short thermo-couple junction; heat, the motive power, is then able to do work, and drives them in frictional stress against their slower but more enduring neighbors, which is the true explanation we have been looking for.

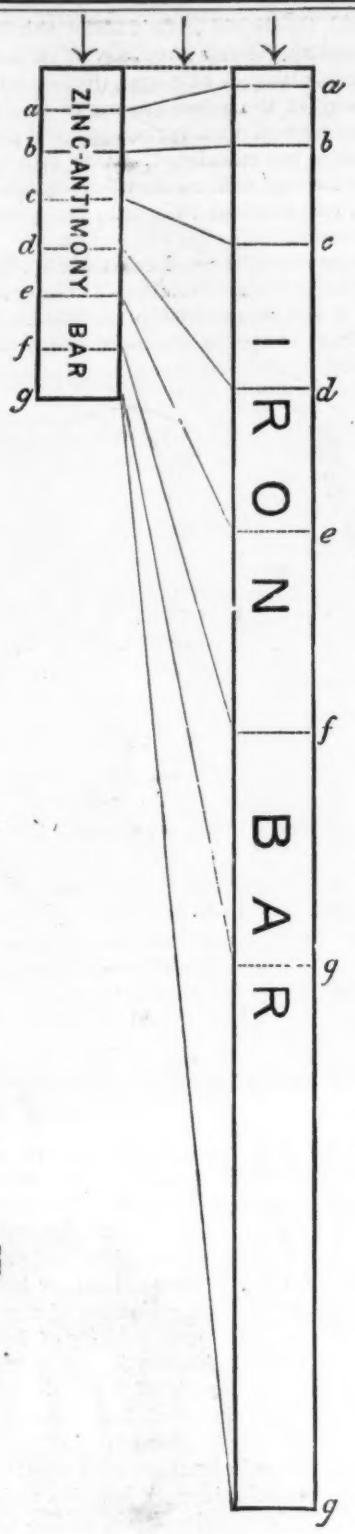
Therefore, understanding now the action of this combination, we simply have to continue more experiments, and to make more thermo-couples to conclusively prove our point, for, the greater the friction and flow of molecular vibrations we can really get into play,—so long as there is a continuous flow, and no counter E. M. F,. or drag, brought about,—the greater will be the E. M. F. produced.

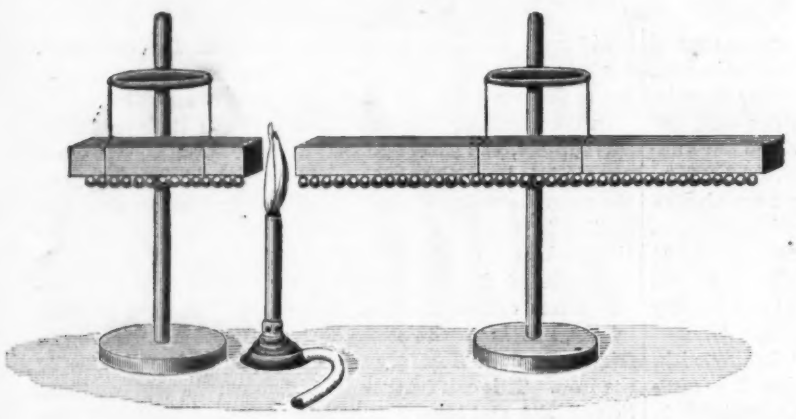
We might also compare the molecules of the Z-A and iron to two sets of cog wheels, with their cogs interlocking, but only vibrating, not revolving. The Z-A cogs, moving the sooner, act upon the series of iron cogs, and therefore the faster and stronger the Z-A cogs run, the greater the friction upon the cogs of the iron, and the greater the E. M. F. generated. Or we might compare them to two sets of springs interlocking—the Z-A springs starting first, move in *continuous vibration* upon the iron springs. Evidently, then, if any of these iron cog wheels in any part of the machine (thermo-couple) have a quicker and more

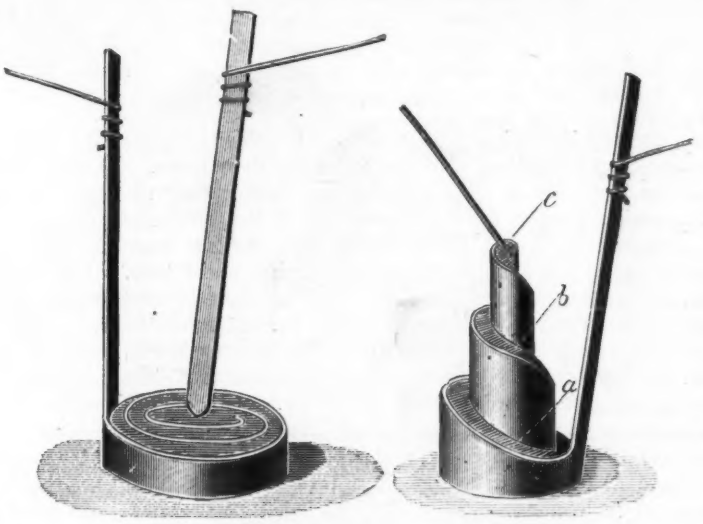
powerful swing than the Z-A cogs, a counter force is brought into play, and a smaller molecular stress, or E. M. F. is produced. So that, if we can by any process, or by any means, get the iron cogs to vibrate more powerfully than the Z-A cogs, we shall still have an electric current set up, because the molecule cog wheel, or the molecule spring, is doing work and setting up a flow of molecular vibrations, though in this latter case the iron molecular cogs are the motive power in friction or with vibratory stress against the Z-A cogs, and not the Z-A in friction or with vibratory stress against the iron.

With these explanations, before making new couples, we will look into the reason of some of the results indicated in some of the old experiments that have been described. In Figs. 4 and 5 the Z-A cogs move sooner, and have a more powerful swing than the iron cogs; they take up the heat and lose it more quickly than the iron, and the potential stress or E. M. F. having been generated, it is taken away by a touching contact, and the E. M. F. created is recorded in the galvanometer. Now what takes place when Fig. 6 is brought into trial, or when the leads of Figs. 4 and 5 are soldered so as to make a continuous connection? Simply this: The iron or copper lead becomes an incorporated part of that couple, and although there are cog wheels always in action in the couple, the iron cog wheels of the lead, being at the same temperature as the Z-A, are not at work, and no E. M. F. is indicated. We will show this, but without using solder. Take Fig. 4, and instead of a thin copper or iron lead let us use a fine strip or bar of copper, and let the end of this touch the couple, as in Fig. 20; what does the galvanometer indicate? Forty degrees deflection!

Now let us place this copper bar flat across the couple, Fig. 21; the galvanometer falls to 3 degrees. If it had been soldered it would have indicated zero, but some small air spaces are between, and some few of the Z-A cogs are yet moving or in the ascendancy. Of course the main cause of this alteration is the change of the position of the copper bar, which in the second case allows the iron molecules to be almost the same temperature as the Z-A molecules, and which, therefore, is acting as a drag, *i. e.*, preventing the Z-A molecular cogs from doing work upon the iron molecular cogs. Fig. 7 shows the same cause at work in a modified form.







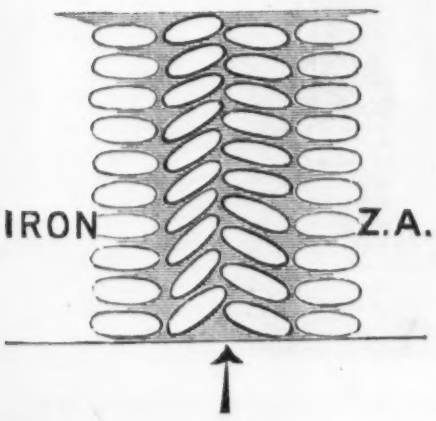
FIGS. 16, 17 20, AND 22.—STUDIES IN THERMO-ELECTRICITY.

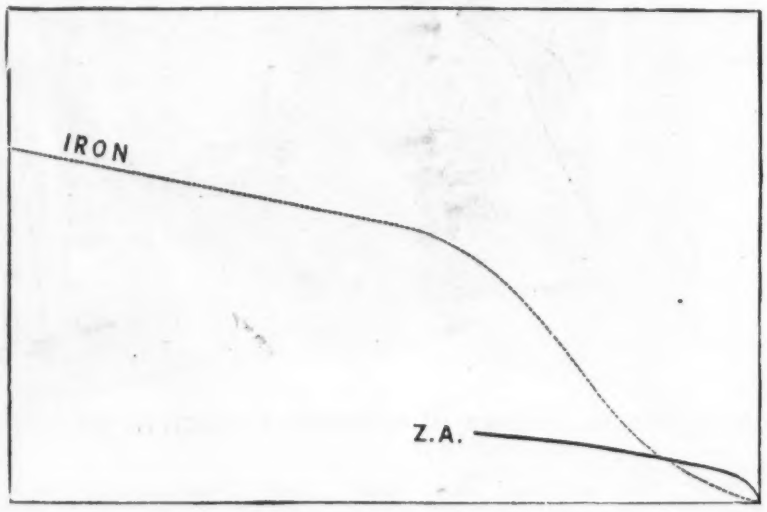
The galvanometer shows, Fig. 4, at 375 degrees F., that the Z-A molecular cogs have the most power, but when the couple is plunged at this temperature into the pot of melted wax, all molecules, both Z-A and iron are brought to the same degree of heat, therefore no molecular stress, Z-A against iron or iron against Z-A, is possible; the two sets of molecules in this couple are now in a state of unison, and for that reason no electrical energy is generated.

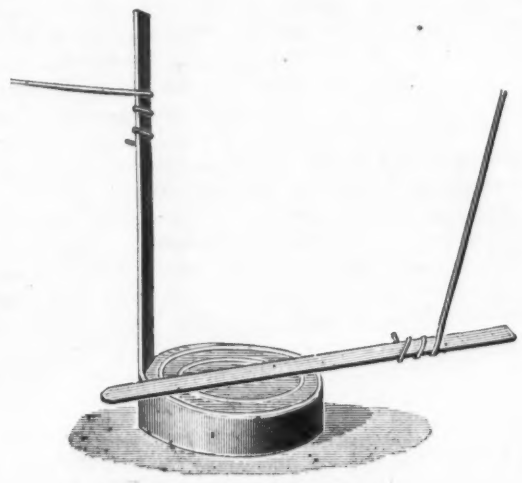
Now let us take Fig. 9, but transformed into a new couple, breaking off the outside Z-A, Fig. 22. When we tried Fig. 9 couple in the original form it gave 40 degrees deflection, but now, taking the spare lead and touching the alloy Z-A at the top *c*, it gives about 41 degrees, or similar results to the old thermo-couple. Now at *b* it gives, after the galvanometer has come to rest, 44 degrees, and at *a*, 48 degrees. The explanation of this is the same. At *c*, the iron has brought up the heat and is causing a drag upon Z-A cogs when the galvanometer gives 41 degrees; at *b* this drag is smaller, and gives 44 degrees; at *a* it is smaller still, and gives 48 degrees; and no doubt, had we tried the Z-A lower down, where there would be still less drag or back friction, this furnace of cog wheels would give 50 degrees at least.

Fig. 10, after allowing for the thermo properties of the metals, we think, explains itself. Fig. 11 shows, in this particular form, that all the E. M. F. generated is not taken off by one lead.

In Fig. 13, instead of connecting up both ends, let us fasten only one end to the iron, and with the loose end touch the alloy at *a*. What do we now get?—48 degrees on the galvanometer instead of 42 degrees! This shows that the top iron has taken up a great deal of heat, and brings in a counter E. M. F. or drag, and thus prevents the full working of the Z-A cogs, as indicated by the galvanometer.







FIGS. 18, 19 AND 21.—STUDIES IN THERMO-ELECTRICITY.

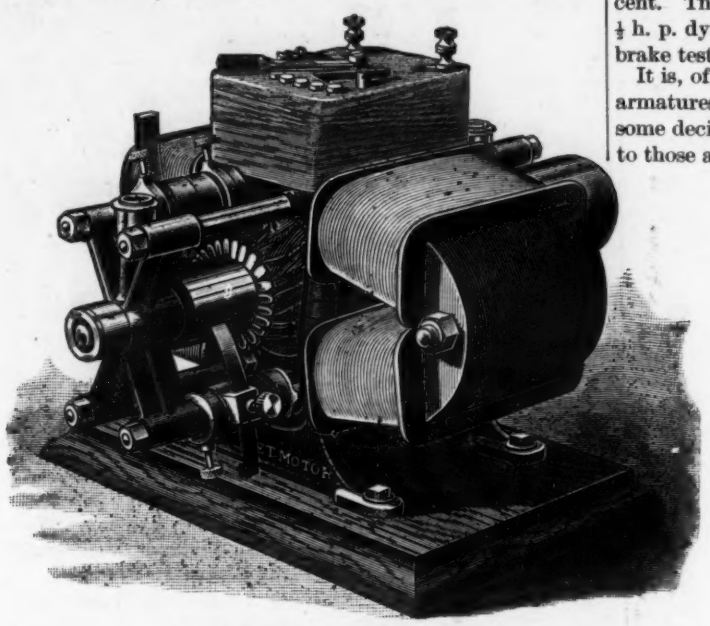
We have seen that these experiments do not bear out the old law, viz.: "That the greater difference in temperature between the two ends of a couple, the greater E. M. F. will be produced." For we have shown, Fig. 12, that couples 3½ inches high, give 33-34 degrees on the galvanometer; Fig. 13, 1¾ inches high, 42 degrees; and Fig. 14, 1½ inches high, 49-50 degrees. But we find that if we make the wire gauze into thermo-couples 1¼ inches high, we shall have a still *less* difference in temperature between the two ends of the two couples, but we increase our E. M. F. considerably; the same heat easily showing 60 degrees deflection. Two couples with heat 450 degrees F. can be made to indicate 80 degrees. At this temperature the thermo properties of the iron are, of course, much improved by the Thomson effect. Indeed, rightly applied, 100 degrees difference in temperature gives better results than 200 degrees applied wrongly.

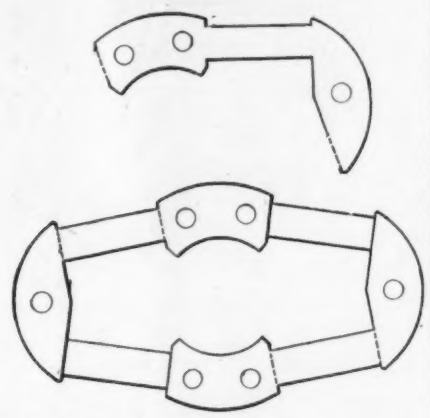
Novel Experiments on Light and Electricity.

An experiment described by M. J. Borgman has an important bearing upon the explanation of the remarkable discovery of M. Hallwachs, in which a beam of light seems to act as a conductor for an electric current. The latter experiment consisted in placing a piece of metallic gauze parallel with, but insulated from, a second sheet of metal. The first is connected with the positive, the second with the negative, pole of a battery, and in one of the leads a delicate galvanometer is placed. If, now, a beam of light be made to pass through the gauze, and to fall on the plate behind, a current is set up in the circuit, and continues to flow as long as the illumination is maintained. It has, moreover, been shown that the action is due to the ultra-violet waves. Now, M. Borgman wanted to ascertain whether or not the effect was instantaneous; that is to say, whether the commencement and the cessation of the current was or was not simultaneous with that of the illumination. M. Borgman probably reasoned that, if the beam acted in some sense as a conductor of the current, the effect must be instantaneous; while if the phenomenon resulted from some secondary action, it would probably go on increasing up to a certain point with the duration of the illumination, and it would also probably continue for a time after the light had been cut off. His method of making the test was equally simple and ingenious. The light was interrupted at rapid intervals by means of a rotating disc with holes or slits, and he placed a telephone in circuit with the battery. It is, then, obvious that, if the effect is instantaneous, the telephone will produce a note corresponding in pitch to the velocity of the disc; if otherwise, there will be silence. There was silence. A make and break in any other part of the circuit could be heard, but not in the beam of light; hence we must seek for some secondary action on the surface of the plates to explain M. Hallwachs' experiments.—*The Electrician*,

The Perret Motors and Dynamos.

We have already illustrated in these columns* the Perret electric motors, built by the Elektron Manufacturing Company, of Brooklyn, N. Y., and are now enabled to give further details in relation to their construction and operation. The distinctive feature of these machines, it will be remembered, is the method of constructing the field magnet, whereby the well-known advantages due to lamination and to the best quality of iron are secured, while the cost, which has heretofore been a bar to the commercial use of such magnets, is reduced nearly to that of forgings. This method of construction is peculiarly adapted to machines of small size, and by its use their efficiency is greatly increased, as the test below shows. It may also be used to advantage in machines up to 10 h. p. and even higher, as by the ingenious shape and arrangement of the plates a magnet of large size may be built up of comparatively small plates, which are stamped from sheet iron, no other machine work being necessary. Eight sizes, ranging from $\frac{1}{12}$ to 2 h. p., are now being made and others are nearly ready. In the $\frac{1}{12}$, $\frac{1}{4}$ and $\frac{1}{2}$ h. p. sizes, a magnet of the ordinary U-shape is used, in which the plates are so formed and put together that the limbs may be swung apart and clamped to the face plate of a lathe for winding, after which they are swung back and bolted fast.





FIGS. 1, 2 AND 3.—THE IMPROVED PERRET MOTOR AND DYNAMO.

In machines of $\frac{1}{4}$ h. p. and upwards the double horseshoe shape, with consequent poles, Fig. 1, is used. Upon removing the two bolts which pass through the yoke, the top half of the magnet may be separated from the lower half. Each half is then attached to a lathe and wound by revolving it, after which they are put together and the bolts replaced, all these operations being very simple and very rapidly done. One of the plates of which these magnets are built is shown in Fig. 2. Four of these are necessary to form the complete inclosure shown in Fig 3. It will be noticed that the plates interleave at the yoke, at which point their cross-section is enlarged, and they are clamped firmly together by bolts. Little or no magnetic polarity is found at the yoke, which shows that the joint is good.

An important feature is the extremely low resistance of the magnetic circuit, which is due partly to the superior quality of iron, the use of which is allowed by this construction, and partly to the smallness of the air gap between the pole pieces and the iron of the armature, which is of the drum type, with teeth. In the longitudinal recesses formed by these teeth the armature coils are wound. This construction increases the efficiency, allows a large reduction in armature speed, and improves the regulation. Thus the $\frac{1}{2}$ h. p. machine weighs complete, with pulley, seventy pounds, and has a commercial efficiency of eighty to eighty-five per cent. As a shunt-wound dynamo it will generate a current of four ampères at 110 volts when run at a speed of 1,800 revolutions per minute. The armature is wound with 7,000 inches of conductor, which gives about 64 inches per volt at the remarkably low peripheral speed of 1,500 feet per minute.

It may further be stated of the $\frac{1}{2}$ h. p. machine, that the drop in electromotive force when run as a dynamo, and the variation in speed as a motor, are less than five per cent. between full load and no load, as shown by the Prony brake test given below.

The motors are usually shunt wound, and on constant potential circuits run at practically a constant speed, regardless of changes in load. This regulation is due to the fact, not always given its full weight, that the regulation of a shunt-wound machine depends not only on the internal resistance of the armature coils, but also to an equal, if not in a larger degree, on the intensity of the field. In other words, the lower the internal resistance of the armature coils, and the lower the resistance of the magnetic circuit, the closer will be the regulation.

This is clearly demonstrated by recent experiments with a $\frac{1}{4}$ h. p. motor on a 110-volt circuit; which, with an armature without teeth, the air gap being $\frac{3}{16}$ of an inch and the internal resistance 11 ohms, showed a variation in speed of 15 per cent. between no load and full load, while an armature having teeth by which the air gap was reduced to $\frac{3}{32}$ of an inch, but with the internal resistance of the armature increased to 20 ohms, showed a speed variation of only 11 per cent. The same thing is shown by the performance of the $\frac{1}{2}$ h. p. dynamo cited above and also by the details of Prony brake test.

It is, of course, not claimed that the use of toothed-drum armatures is new, but Mr. Perret finds that they possess some decided advantages over plain armatures in addition to those already stated, as, for instance, positive driving of the coils secured by winding them in the recesses; he finds also that when used with finely laminated field magnets they are free from some disadvantages experienced in other constructions. It is quite certain that such armatures running in close proximity to solid pole pieces would produce heating effects therein which would be wasteful and very troublesome, to say the least. With laminated field magnets, however, all such trouble is avoided.

A characteristic of these machines is their freedom from sparking at the commutator, provided this is kept in reasonably good condition, and the brushes, having been once set at the non-sparking point, require no changes under extreme changes in load. A rocker-arm for the brush-holders is therefore unnecessary and the machine is thus simplified. The reason for this will be readily understood from the foregoing description, and lies in the fact that the magnetism of the field is so powerful, relatively to that of the armature, that no distortion of the lines of force is produced, and consequently the line of commutation remains unchanged, regardless of changes in load.

It may be said further that these machines have been worked out very perfectly in every detail, and a high degree of mechanical skill is shown in their construction. The armature shafts are of high grade steel. The commutators, which ordinarily are liable to great wear and damage, have received particular attention, being made of a special hard bronze.

The following table shows the results of an efficiency test of a $\frac{1}{4}$ h. p. Perret motor:

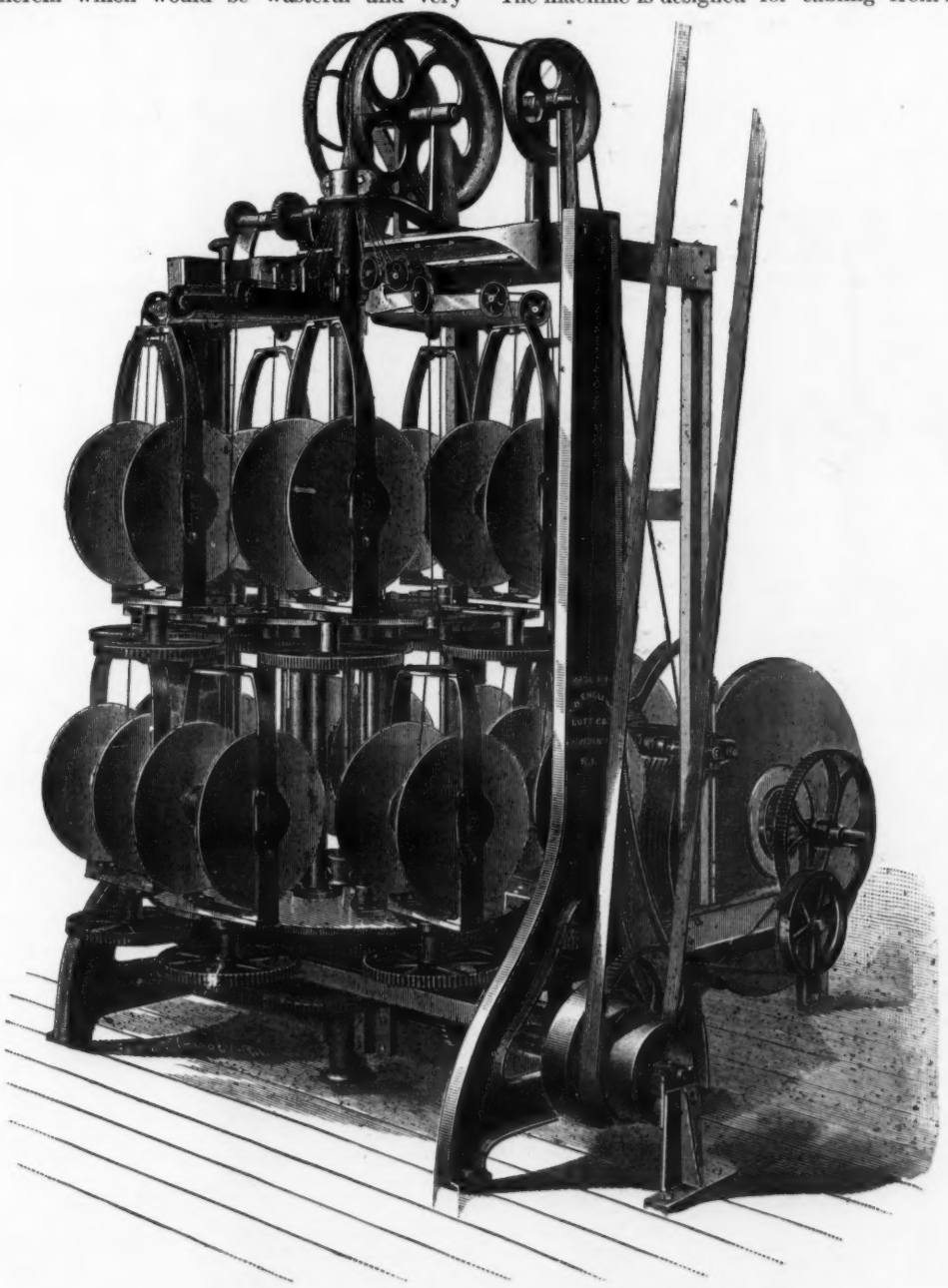
Brake H. P.	Speed.	Commercial Efficiency.	Brake H. P.	Speed.	Commercial Efficiency.
.146	2050	.73	.400	2030	.80
.185	2048	.74	.432	2024	.81
.219	2046	.745	.467	2018	.815
.250	2044	.76	.501	2010	.82
.290	2042	.77	.536	2000	.80
.320	2040	.78	.569	1995	.78
.365	2035	.79	.600	1990	.76

In order to make the machine self-contained and to avoid the use of a separate rheostat, a switch is placed on top of the motor, as shown in Fig. 1, and resistance coils in the base. They are so constructed that when the switch is moved to the first contact point the field circuit is closed, and at the same time the armature circuit is closed through all the resistance coils. As the switch lever progresses from point to point, one coil after another of the resistance is cut out until on the last point, and after the speed of the armature has reached nearly its normal rate, it is all cut out. A simple but effective device makes it impossible to leave the switch on any but the last point.

New 12-Strand Cabling Machine.

We have already described the braiding and winding machinery for covering electrical conductors built by the New England Butt Company, of Providence, R. I. Among the special machinery recently brought out by them is the cabling machine illustrated in the accompanying engraving.

The machine is designed for cabling from six to twelve wires around a centre composed of other wires. The reels on each carrier are made of iron, with a 17-inch head and 9½-inch traverse, with six carriers to each disc, and a hollow-centre spindle. The wire after being cabled passes from the feed wheel down to the drum at the back of the machine, which is 36 inches diameter of head, with 30-inch traverse, and is guided on uniformly by a traverse motion variable according to the size of cable. The drum is easily replaced when full by simply lifting it off the machine.



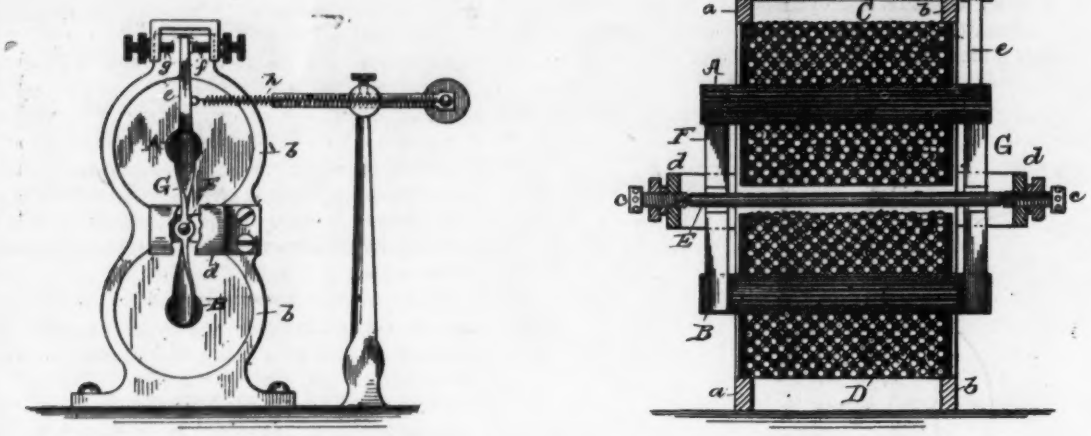
A NEW 12-STRAND CABLING MACHINE.

These machines are made in four sizes, with three, four, six and twelve carriers; any less number of wires can be cabled by leaving off reels. The machine is driven by a three-change cone pulley for a variation of speed to suit the different classes of work.

*See THE ELECTRICAL WORLD, Feb. 2 and July 6, 1889.

Healy's New Quadruplex Relay.

In quadruplex telegraphy an ever-present factor has been what is known as the "bug"; that is, the defect in the operation of the second or neutral side, on long lines, which is specially manifested in bad weather, when the received current from the distant battery is greatly reduced by leakage.



FIGS. 1 AND 2.—HEALY'S NEW QUADRUPLEX RELAY.

This trouble in the practical operation of the quadruplex is due to the fact that the operation of the first side is by means of reversed currents and a polar relay, while the second side operates by increasing and decreasing the current regardless of its polarity, the received signals coming in on a neutral relay whose armature is held back by a spring. If the key for the second side is closed and the current increased, the relay closes its sounder, and if, during this time, the current on the first side be reversed, a momentary interval will occur in the magnetism of the neutral relay cores, allowing its armature to fall off and produce false signals, and as the line becomes longer, or a heavy leakage occurs, this trouble increases.

To overcome this trouble Mr. Clarence L. Healy, of this city, has designed a new form of relay, illustrated in the accompanying engravings. The relay, as will be seen, is made with short cores in order to obtain a quicker reversal, being one inch long with coils one and one-half inches in diameter, with back yoke, making the magnetic circuit four inches long. As the coils are wound differentially, it allows one-half inch for wire on each core, and this is wound with very fine wire, which, of course, increases the self induction very much, thereby increasing the trouble of slowness to accept reversals.

In order to remedy this magnetic defect, induction coils and condensers in connection with extra magnets have been used with varying results. The difficulty in the use of condensers or induction coils which send a current through an extra magnet, is due to the fact that during wet weather, when the trouble is the worst, the means of operating these devices due to the received current is correspondingly reduced.

The relay shown in Figs. 1 and 2 is designed to make the magnetic circuit as short as possible, and to remove, as far as possible, all magnetic lag due to the cores and also the self-induction due to the windings themselves. *A* and *B* are two single coils having a magnetically insulated iron wire core, the length between the rubber heads being about two inches. At each end the cores project and are beveled, as shown, and at each end, fastened to a shaft between the coils, are two adjustable armatures shaped like a propeller blade.

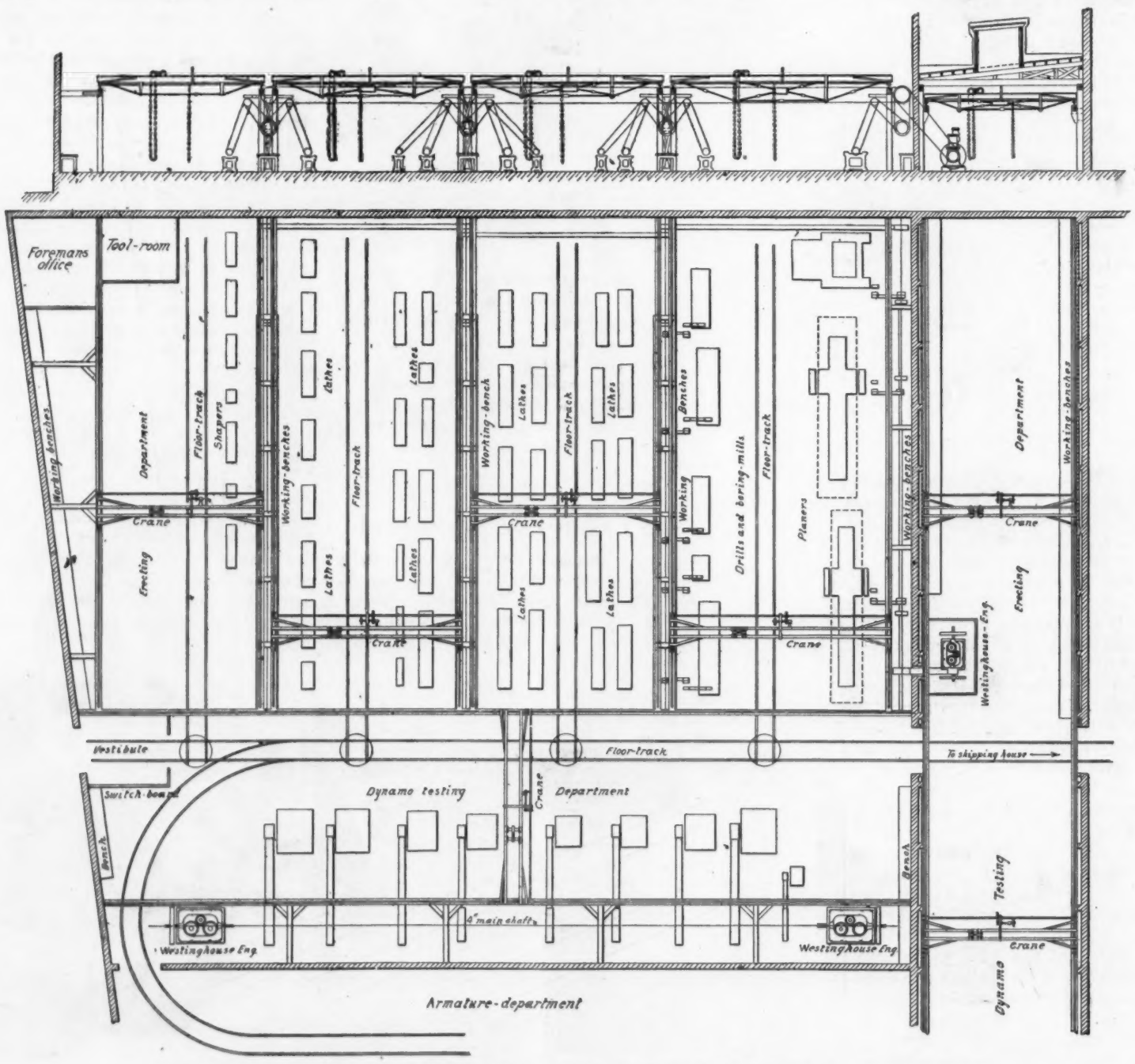
When a circuit passes through one of the windings (the coils being wound differentially) the two armatures are attracted, tending to form a closed magnetic circuit through the two coils and armatures. These armatures being on a slant, still further shorten the magnetic lines, as each iron wire of the core acts on the armature, and gives a large attractive surface between the cores and armatures. The wire space being four times as large, and extending over the whole length of the cores, allows a larger wire to be used, with, consequently, very much less self-induction and increased magnetism due to a greater number of convolutions.

In actual practice, when the relay is placed on long lines and reversals sent from a distant battery, the armature holds up with a slight tremor, whereas a relay of the old form placed in the same circuit falls off badly at each reversal.

Overhead Cranes in the Westinghouse Factory, Pittsburgh.

The accompanying illustration, for which we are indebted to the *Railroad Gazette*, shows the arrangements of the new shops of the Westinghouse Electric and Manufacturing Company in plan and longitudinal section, illustrating particularly the system of overhead cranes in use. These shops occupy, with many additions and alterations, the building formerly used by the Union Switch and Signal Company, on Duquesne Way and Garrison Alley, Pittsburgh. The heavy dynamo work is done in this machine shop, an iron-clad building, which is that part of the structure formerly used by the Union Switch and Signal Company for erecting signal posts, frogs, etc.

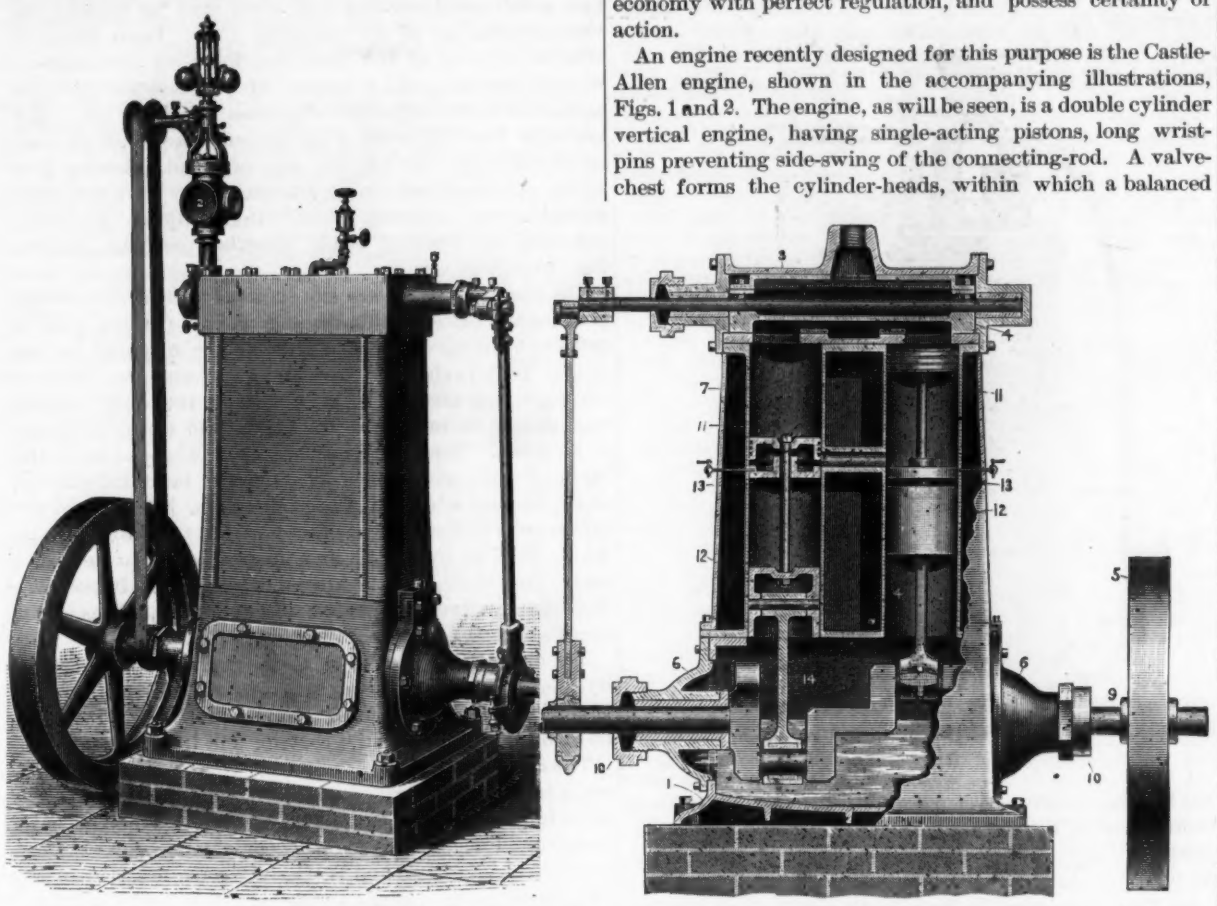
The shop was laid out by Mr. Albert Schmid, Superintendent of Shops, with the view of reducing to a minimum the labor incident to the erection of machinery. It is composed of five divisions, each traversed by a 10-ton traveling crane. It was impossible to carry the shafting from the roof, and, therefore, it was determined to employ pillars to furnish a support for the shafting hangers. These pillars also support the cranes. The result is a well-arranged shop, in which all the work can be handled by traveling cranes. The traveler guides and supports are formed of timber, the guides being spliced and the posts well braced together. The girders of the travelers are formed of two stout channel irons, with wooden filling pieces bolted to the hollow sides of the channels. The traveling trolley carries a pair of Harrington's hoisting blocks; these blocks and the whole traveler can be made to traverse the entire



ARRANGEMENT OF THE NEW WESTINGHOUSE ELECTRIC FACTORY AT PITTSBURGH.

length of the shop by means of suitable gearing, worked from the ground by endless hand chains.

The arrangement of the shafting is shown in the illustration. The main shafting is carried between the posts supporting the traveler guides. The counter-shaft brackets are attached to the traveler guides. A line of rails runs down



FIGS. 1 AND 2.—THE CASTLE-ALLEN ENGINE.

the centre of each aisle between the machine tools, and on trucks running upon these rails all parts of machinery can be loaded and taken to another shop or to the yard and delivered to drays to be conveyed to freight yards for shipment. The rough castings are delivered from the foundry to the Duquesne Way side of the shop, where they are picked up by a crane and conveyed to the division marked "Planers and Boring Mills," thence they travel through the division marked "Lathes" to the testing room, which runs longitudinally through the shop. At this point the dynamos are supposed to be completed, and are then subjected to a thorough test, after which they are sent to the shipping room.

One 100 horse-power Westinghouse "Standard" engine runs the main machine shop. Two 250 horse-power Westinghouse engines, coupled to a 4-inch main shaft, drive the dynamos in the testing room. On the main shaft are friction pulleys, by means of which any individual dynamo can be coupled on at any time without interfering with others that are running. All the main and counter-shafts are so arranged as not to interfere with the cranes. At present the overhead cranes are driven by hand-power, but they will soon be fitted with alternating current Tesla motors.

The Castle-Allen High-Speed Engine.

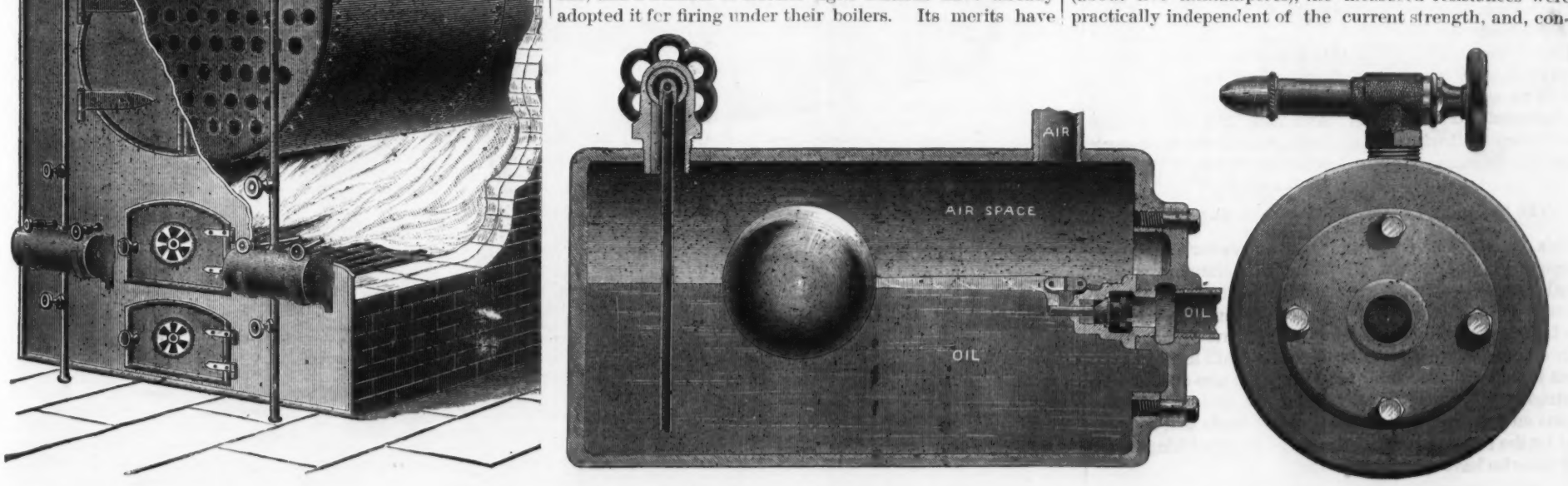
The demand for an economical high speed engine, specially adapted for operating dynamos in connection with train lighting, has grown to an extent that justifies engine builders in bringing out special types of small machines that are simple in mechanism and which develop high economy with perfect regulation, and possess certainty of action.

An engine recently designed for this purpose is the Castle-Allen engine, shown in the accompanying illustrations, Figs. 1 and 2. The engine, as will be seen, is a double cylinder vertical engine, having single-acting pistons, long wrist-pins preventing side-swing of the connecting-rod. A valve-chest forms the cylinder-heads, within which a balanced rocking-valve, operated by an eccentric, distributes the steam to the cylinders through very short and direct ports. The crank case is the base of the engine and also the oil reservoir into which the crank dips at each revolution and throws the oil upon all wearing parts and upon the main bearings. The cylinders and valve are lubricated in the usual manner. The piston head is usually made as a solid disc fitting the bore of the cylinder closely, and into these heads eccentric rings are sprung, making an easy sliding fit and free from leakage. The piston rod extends from the piston head above through a stationary head fitting the bore closely, and having metallic packing, thus preventing the water of condensation from entering the oil case below. The Castle Engine Company, of Indianapolis, manufacturers of this engine, claim that it can readily be adapted for compound or triple expansion requirement with high economy.

Improved Aerated Fuel Burner for Firing Boilers.

The low cost of crude petroleum oil, combined with its great heating powers, is making this form of fuel a favorite one, and a number of electric light stations have already adopted it for firing under their boilers. Its merits have also been especially dwelt upon at the meetings of the National Electric Light Association. This method of firing, however, requires some special arrangement, and, in order to thoroughly utilize the heat energy contained in the oil the Aerated Fuel Company, of Springfield, Mass., have recently devised a system in which this is thoroughly accomplished.

The method employed by them consists in employing compressed air to force the oil through a burner, by which it is atomized and at the same time thoroughly mixed with air. The general arrangement of the furnace for this purpose is illustrated in Fig. 1, which shows a boiler arranged with two burner cylinders, each provided with two burners. The burner cylinder itself is shown in longitudinal and transverse sections in Figs. 2 and 3. As will be seen, the valve is placed on the under side of the cylinder, the object being to prevent the flowing of oil into the cylinder and rising above the mean level established in any one factory. It will be noticed that if, from any cause, the float should sink it will also close the valve, thus preventing any possibility of flooding the furnace or overflow in the tanks. A long pipe is screwed into a T-joint, and when the burner is in its place in the cylinder this small tube reaches to within one-half inch of the bottom of the cylinder.



FIGS. 1, 2 AND 3.—IMPROVED AERATED FUEL BURNING APPARATUS.

The air space at the top of the burner cylinder is filled by the compressor, which maintains an air pressure of from 10 to 25 pounds per square inch. The burners are made in sizes, depending upon the size of the boiler to be fired, and the results obtained are said to be highly satisfactory, effecting economy in fuel and maintaining a uniform pressure upon the boiler.

The Law of Probability of Error as Applied to the Observed Electrical Resistance of the Human Body.

BY A. E. KENNELLY.

It is generally admitted that all social phenomena are in the aggregate controlled by the general law of probability of error, and statistics, it is claimed, show that the proportions, weight, intelligence, and in fact all measureable properties of animated beings, at any given time and place, centre about some mean value, the divergences from which follow the law of probability of error in observations. This leads to the inference that nature endows all organisms with slight variability of type in a high degree, any one quality being the resultant of a great number of factors, so that the general mean is reached through the summation of all possible variations of those factors, as many variations being ultimately positive as negative. The law has probably not been stated for the measured electrical resistance of the human body, but the following observations may fairly be said to indicate its application:

Two hundred and twenty men and boys were measured at Mr. T. A. Edison's laboratory for the resistance they offered between the hands with liquid contact. The measurements were all made on the same day, and as nearly as possible under the same conditions. Two glass jars, 15 centimeters (6 inches) in diameter and 20 centimeters (8 inches) deep, containing an aqueous solution of caustic potash (density 1.10), were connected by immersed copper sheets, 15 centimeters × 29 centimeters (6 inches × 15½ inches), with a Wheatstone bridge. The reason for adopting caustic potash solution was that in a previous test with 39 men their mean resistance between the hands immersed in this solution was found to be 30 per cent. less than when aqueous zinc sulphate solution, of density 1.13, and zinc electrodes were used, all other conditions remaining unaltered.

The testing battery had a low resistance and an E. M. F. of 8 volts. The bridge ratio was $\frac{1000}{1000}$, and with the dead beat galvanometer employed, readings could easily be taken to one ohm in 2,000.

The measurements were made in such a manner as to eliminate almost entirely the effects of polarization. Under these circumstances it was found that between the limits of the feeblest current by which an observation could be obtained and the strongest current that on starting or interruption could be conveniently supported by the men, (about five milliampères), the measured resistances were practically independent of the current strength, and, consequently, of the battery power employed. The resistances, however, decreased with the surface area of immersed skin, and also with the period of immersion, in many instances falling about 100 ohms in the first 30 seconds. To obtain comparable results, therefore, the hands of the person tested were plunged, pointing vertically, downward into the jars until the tips of the middle fingers rested on the bottoms, and the measurement was made as closely as possible 30 seconds after immersion. The readings were carried to the nearest 10 ohms, units being negligible even if the

resistance had been steady enough to render them distinct. The variations in these measurements would include not only differences in the resistance of the arms and trunk, but also the variations of thickness in the epidermis, area of hand surface, as well as errors of observation and time. All these disturbing conditions, however, may be regarded as belonging to the class of observational error, and simply tend to make the measurement of the resistance within the body less precise. The age, height, and weight of the subject were recorded with each observation. No dependence of the resistance upon these qualities could be noticed, but the boys had apparently a higher resistance and stoutly built men a low resistance. Thus the four boys of ages under 16 gave an average of 1,218 ohms, while the nine cases of men, whose weight exceeded 175 pounds, gave an average of 770 ohms.

The average of all the 220 measurements was just 1,000 ohms, and the sum of the divergencies from this mean value taken without regard to sign was 27,920.

From these data we obtain by the application of the usual approximate formulæ of probability the following table in which the actually observed and calculated divergences are compared.

Divergence between.	Caculated number of cases.	Observed number of cases.	Difference.
0 and 50 ohms ±	54	47	7
50 ohms and 100 ohms ±	49	56	— 7
0 and 100 ohms	— 103	— 103	— 0
100 ohms and 150 ohms ±	41	38	3
150 ohms and 200 ohms ±	30	40	—10
100 and 200 ohms	— 71	— 78	— —7
200 and 250 ohms ±	20	13	7
250 and 300 ohms ±	13	10	3
200 and 300 ohms	— 33	— 23	— 10
300 and 358 ohms ±	7	7	0
350 and 400 ohms ±	3	1	2
300 and 400 ohms	— 10	— 8	— 2
400 and 500 ohms ±	2.6	4	— 1.4
Over 500	0.4	4	— 3.6

The agreement is seen to be very fair, except that there were more large discrepancies of over 500 ohms than theory would account for.

The highest observed resistance was 1,970 ohms and the lowest 660 ohms.

Under the conditions of this test, therefore, it was an even chance by the theory of probability that any man's resistance would be within 108 ohms of 1,000, *i. e.*, would lie between 892 and 1,108. As a fact, 115 out of the 220 observations fell within those limits, so that the final result of all the measurements was 1,000 ohms ± 108.

The St. Louis Universal Electrical Exposition.

This exposition is progressing rapidly under the general management of Mr. Fred H. Whipple. Many novel electrical effects are already arranged for. Thus an immense phonograph will be used to reproduce the music played by the Liberati and Gilmore military bands. An electric street railway complete will be in operation the full length of the great building. A cooking establishment, also operated by electricity, will claim the attention of the visitors. Pianos, organs and musical instruments of all kinds will be operated by the current, and a drum corps of astonishing effect will likewise have wire connections.

Determining the Horse-Power of Motors.

July 26, 1889.

To the Editors of The Electrical World:

Will you please advise me through the columns of your paper how the "horse-power" of electric motors is ascertained? W. C. K.

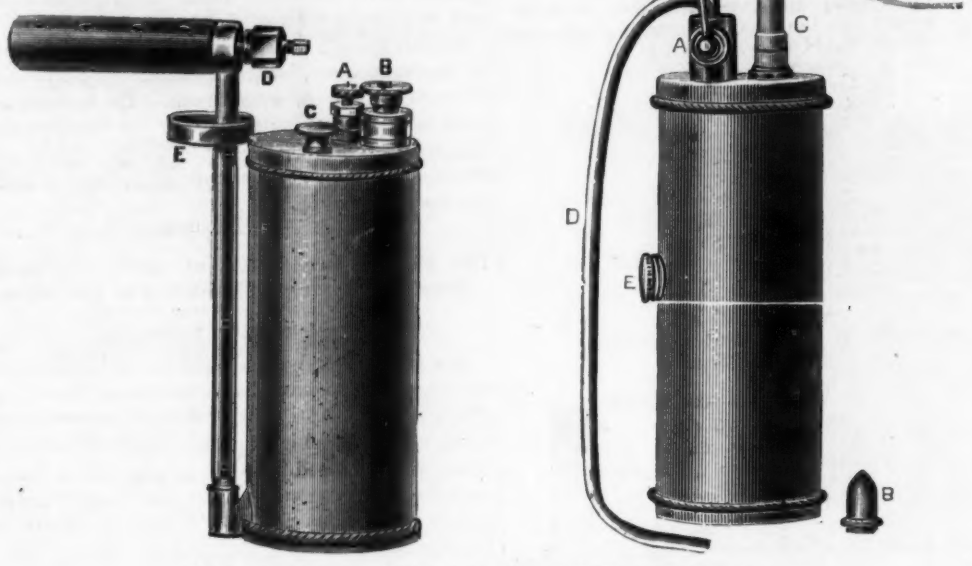
Providence, R. I.

Answer.—The best way to ascertain the horse-power of an electric motor is to apply a Prony brake or transmitting dynamometer. If the exact efficiency of the motor is known, the horse-power can be obtained by measuring the E. M. F., *E*, and current *C*, at the terminals, multiplying these together and by the coefficient of efficiency, and dividing by 746.—Eds. E. W.

Linemen's Torches.

A soldering torch is a necessity to every lineman doing construction or repair work, and to be of service its mechanism must be so simple in construction that it cannot get out of order and will permit of being used at any angle, even bottom side up.

Fig. 1 illustrates a torch especially designed for such service, being practically a sealed torch with pumping rod.



FIGS. 1 AND 2.—THE WALSH GASOLINE TORCH.

Two burners of different size are sent out with each torch accompanied by a small pocket wrench which enables the wireman to remove the burner when the work is finished and place the torch in pocket or grip. A small nut on the end of the burner permits the adjusting of the heat from a bushy blaze to a long and slender flame. Practical demonstration has shown that the expense of operating this torch does not exceed one cent per day's work.

Fig. 2 represents a torch designed for lighter work, as house wiring, etc., with soft rubber tube *D* attached. In size it is only 6 × 2½ inches and can readily be carried in the pocket after removing the burner *C* and screwing on the cap *B*. The size of flame desired is adjusted by the screw *A* from "intense heat" to a flame as thin as a needle. Its capacity is such as to permit of five hours' constant use, costing for a day's work about four cents. These burners are placed on the market by the J. C. Walsh Gasoline Torch Manufacturing Company, Chicago.

An Improved Jointing and Facing Machine for Electrical Factories.

The important effects which the new developments in electricity have had on the steam engine industry and other departments have often attracted attention and excited comment. In fact the finished dynamo or motor, while adding enormously to the world's comfort and wealth in various forms, has been very much of a revolutionary agent in methods of light and power distribution. In a similar manner it will be found on investigation that the production of these machines has led to the employment of many new appliances, and that it has begun to affect the shape and style of tools and machines, causing innovations sometimes the reason for which is not apparent save to those who have studied the newer requirements with a view to meeting them.

The idea here hinted at is even more clearly and concretely brought out by the cut we show of a new and improved jointing and facing machine, commonly called a "buzz planer," recently introduced for electrical purposes by the S. A. Woods Company, of Boston. It is really surprising how much wood working is now required to furnish the various adjuncts of an electrical plant, from the first wooden patterns of the machine down to the moment when it stands in all its beauty of polished switchboard and other details of perfected fitness for its work. The machine here illustrated is specially desirable in electrical workshops for planing out of wind, making glue joints, etc., and performing a large variety of work, such as rabbeting, jointing, chamfering, gaining, grooving, squaring up, working beads, circular molding, hollowing, rounding, etc.

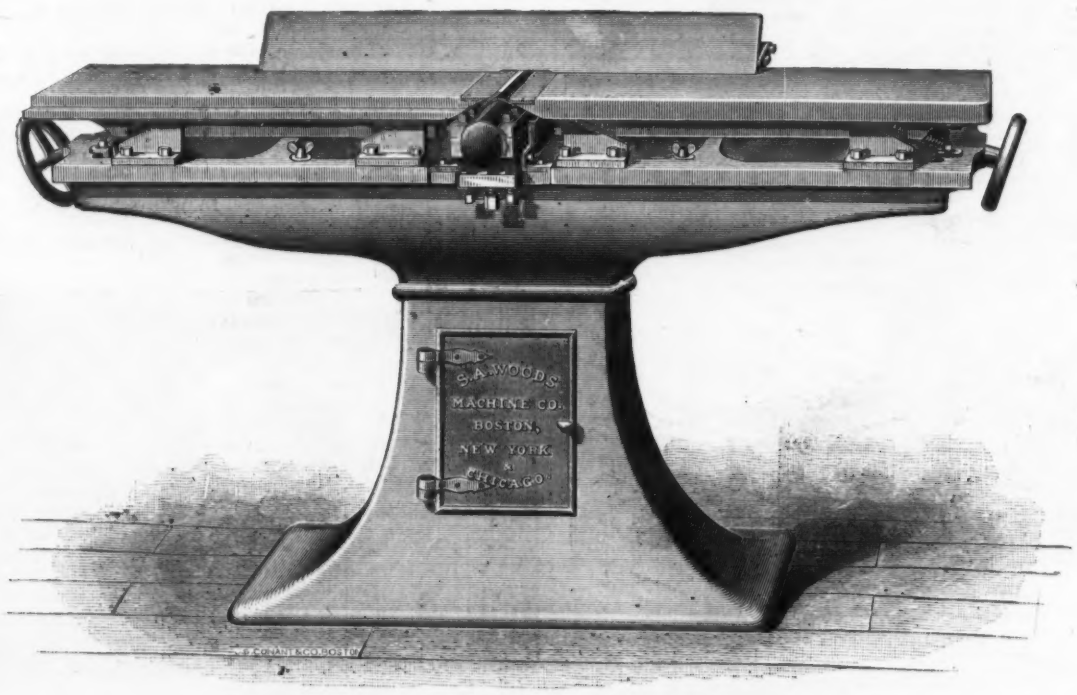
The base and frame are constructed to insure solid support for the cutter-head yoke and working tables, and to prevent twisting strain in securing the machine to the floor. Both parts of the top are adjustable on inclined planes, which method is, it is claimed, the only reliable way to hold them close to the knives and secure accuracy at all times. They can be drawn back independent of the inclined ways, giving free access to the head and cutters, and necessary when using special knives. The ends of the tables next to the head are faced with steel, which can be made thin at the edges and shaped so as to keep the tables near the cut of the knives, which is very important. The edges will remain perfect and not break out, as might occur and cause trouble if they were of cast iron.

The cutter-head is of steel made from a solid forging with long bearings running in improved self-oiling boxes. It is tapped on two sides for straight knives, and slotted on two sides for molding, grooving and irregular cutters.

The cutter-head boxes are yoked together and are always in line. Either end of the yoke can be adjusted, a most important feature, as it allows the end of the head to be raised when the knives become worn uneven, and saves resetting them, and is also very convenient when setting them.

The table is fitted for rabbeting, and the gauge can be set at any bevel up to 45 degrees, or it can be swung diagonally across the cutters and secured in position.

The cut shows a machine five feet long with 12-inch cutters, with tables closed as used on ordinary work. They are made in a large variety of sizes suitable for all branches of wood working.



THE WOODS PLANER FOR ELECTRICAL WORK.

Electric Light Legislation.

Mr. A. R. Foote, as chairman of the National Committee on State and Municipal Legislation of the National Electric Light Association, has issued his final notice prior to the convention of Aug. 5. It is desired to complete the nominations for memberships of the committee, and there are still sixteen vacancies to fill in Western and Southern States. A meeting of the committee is to be held at the International Hotel, Niagara, on Aug. 6, at 7 P. M. Mr. Foote asks the members for suggestions, and submits a "plan of work" to be developed or modified, as circumstances may require. The plan deals with the questions arising from proposed electrical legislation, and recommends the careful watching and study of each bill, a copy of each to be sent to the chairman. Members of the committee are to recommend an attorney for their respective States in readiness for any emergency, and no action is to be taken without the approval of a majority of the committee and of the members in the State affected. The funds of the Association are not to be used for the work of the committee in any way. All work done will be recorded in printed form available for use at once.

The Electrical Exhibition at St. John, N. B.

(From Our Special Correspondent.)

ST. JOHN, N. B., July 26, 1889.

The list of electrical exhibitions, which had already become of respectable length, must now include the great carnival show at St. John, New Brunswick. This town has been *en fete* during the past week and will continue to "celebrate" for yet another half dozen days, and the main attraction throughout has been the electrical exhibition, the first ever held, it is believed, in a British colony, and one which will certainly require no small effort anywhere to equal or surpass.

The occasion for the rejoicing at St. John is of double interest. The city not only has been signalizing its civic union with the sister city of Portland, by which step its population jumps at a bound to 50,000, but it has appropriately taken special pride in the completion of the last link of the great Canadian Pacific Railway, by means of which it is brought into direct communication with the West and the Pacific slope, and has its opportunities of export trade to Europe and the West Indies immeasurably expanded. Some idea of the vast territory which St. John serves as a commercial centre might in fact be very well formed from the manner in which visitors from all parts of the Dominion and Union have poured into the city during the festivities, and from the heartiness with which numerous American companies and individual electrical manufacturers have utilized the exhibition to bring before a public little accustomed to such novelties all the latest inventions, appliances and conveniences included under the generic head of electricity.

The exhibition is being held in the fine buildings of the St. John Exhibition Association, and has been conducted by a strong committee, embracing practically all the electrical talent of the city, and headed by Mr. H. J. Thorne, ex-Mayor. Mr. Ira Cornwall, the secretary of the Association, etc., has had charge of matters generally, and the electrical details proper have been in the hands of Mr. A. A. Knudson, a gentleman well known in electrical circles in New York. Associated with Superintendent Knudson as his assistant is Mr. A. M. Cogswell, a clever young electrical engineer of Halifax. The result of the work of this staff has been most creditable, and St. John has been given an exhibition that is well worth a visit. and that must undoubtedly have a most beneficial effect on the future of electrical applications throughout the maritime provinces.

The exhibition was opened on Monday afternoon, July 22, by Sir S. L. Tilley, Lieutenant Governor of New Brunswick, in the presence of a vast gathering. The proceedings were made doubly interesting by the fact that in addition to the guns fired by electric fuse by Sir S. L. Tilley and his wife, announcing that the exhibition had been opened, other guns were also fired by the same means by Mr. W. C. Van Horne, at Montreal, president of the Canadian Pacific Railway, and by Mayor Oppenheimer at Vancouver, B. C. This performance was remarkably effective in illustrating the rapidity with which the work of consolidating the Dominion is going on and the important part that the telegraph plays in the political system of the British Empire. The wires of the Canadian Pacific Telegraph system run into the building, and the energetic St. John superintendent, Mr. E. W. Snider, saw to it that they were clear at the right moment; and thus the feat of opening an exhibition across 3,000 miles of continent, over a new telegraph system, was very neatly and successfully carried out.

Sir S. L. Tilley was greatly gratified, he said, at the extent and beauty of the exhibition, and it well deserved his praise. The exhibition fills three floors of a building about 200 feet long, 100 feet wide and 75 feet high, with a lofty arched roof; and there are various annexes and outside departments. The whole is tastefully dressed with evergreens and flowers and with flags of every conceivable size and nationality. The first floor is devoted to the heavy machinery. On the floor above are the miscellaneous exhibits, and the third floor contains the art exhibition, together with large galleries running entirely around the main aisle, so as to command a view of everything below.

On the machinery or first floor, Mr. F. A. Barr, of Montreal, representing the Edison Company, has two Edison incandescent machines, each of 300-light capacity, one shunt wound and the other compound. Assisted ably by Mr. James Milne, of his staff, Mr. Barr has practically put in an Edison central station organization or equipment, complete, so that the public can form a clear conception as to the manner in which the current is generated and handled before it reaches the lamps.

Mr. G. F. Calkin, the local agent of the Brush Electric Company, of Cleveland, has two arc dynamos and one incandescent on that floor, as well as a small Brush motor running the printing press of the *Electric Era*, a neat little 4-page paper published at the exhibition, and issuing two or three editions daily. The Thomson Electric Welding Company, of Boston, have a welding alternating current generator, self-excited, and the Ball Electric Company have one of their well-known arc machines. On this floor, too, are the engines and boilers. E. Leonard & Sons, of London, Ont., represented locally by G. H. Evans, have three fine Ball engines, one of which, together with a separate boiler, runs the welding generator. The other engines drive the dynamos mentioned above. The engines mentioned are of 30 h. p., 45 h. p. and 80 h. p., and are excellent pieces of mechanism. The main steam plant comprises a battery of two tubular boilers, belonging permanently to the building, and made by I. Mathesen, of New Glasgow, N. S.

On this floor, facing the entrance, is a fine exhibit of electric light, office and other wires and cables of Holmes, Booth & Hayden, of New York. The exhibit is arranged pyramidically, and the various packages are neatly and prettily got up. Not far off is a very handsome display made by John A. Roebling's Sons Co. This exhibit illustrates all the products of this celebrated house, and includes some fine photographs of the Brooklyn Bridge, etc. The company are represented by Mr. F. A. Dumas, who has made a special trip to be on the ground during the continuance of the exhibition. The Standard Underground Cable Company also have a good exhibit of their various cables, wires, etc.

Proceeding to the main floor above, one is immediately delighted by the spectacle there seen. The space down the sides is divided into bays, each occupied by an exhibit. The 11 springing arches are all wreathed in green boughs and in bunting, and picked out with Edison lamps, which shine like so many stars. At one end is a large platform and band stand prettily decorated, from which music is played by the band afternoon and evening while the exhibition is open. The floral display here reaches well above the head. Over it, on a kind of architrave, stands a beautiful terra cotta bust of Edison, loaned by Mr. F. R. Upton, relieved by a background of white cloth and illuminated by two handsome incandescent reading lamps. Immediately below the bust is the word "Edison" in letters about eighteen inches long, and built up of colored lamps so arranged as to switch on and off letter by letter. The effect is most charming, especially when the band is playing and the conductor wields his baton tipped with an incandescent lamp, which seems to be hovering about the flowers like a huge fire-fly. At the other end of the hall, on the same main floor, is a magnificent cascade with the water breaking down a rocky, mossy gorge and falling into a little lake set in a green lawn. Each step in the cascade consists of a large sheet of colored glass masking Brush incandescent lamps, arranged to turn on and off at will, the water also being under regulation, so that innumerable effects may be obtained. On the right of the cascade is a large plush shield on which the words "Brush-Swan" glow in pea lamps with very pretty effect. More Brush lamps of 16 c. p. are scattered over the lawn, with big Japanese frogs perched on them, or the lamps placed inside large transparent shells. In front of the lake lies a large seal, and on each side are two long-legged storks. The whole is fringed by exotic plants.

Down the centre of the main aisle is found a beautiful flower bed, from the top of which rises a huge Japanese umbrella revolved by a small C. & C. motor. At the top of the umbrella is an Edison lamp, and all around it at the circumference are fixed small Edison lamps with short filaments, of the type used in Canada in connection with the Julien storage cells for train lighting. Beyond the "umbrella stand" is a large platform occupied by the Æolian Organ and Music Company of New York, represented by Landry & Co., of St. John. The company have an exhibit of their electric organs and pianos, in which the pipes are blown and the strings are struck by means of electric motors, which operate in conjunction with traveling rolls of embossed paper. The organ shown is run by a C. & C. motor, taking current from the Lahmeyer incandescent dynamos near by, and the piano motor obtains its current from a set of four Julien storage batteries. This platform is lighted by Edison lamps fixed on a lofty brass standard.

Facing toward the band platform, on the right. is seen the neat little telegraph office of the Canadian Pacific Telegraph Company, and on the left is a "tropical garden" which revolves slowly. In among the plants and flowers and rare stuffed birds are colored Edison lamps, and at the top is an eagle with a lamp hanging by a flexible cord from its beak. Facing around again, and looking toward the other end of the room, one sees in the gallery an electric fountain where the water plays over colored Edison lamps. It may be noted that the water which is here and in the cascade used so copiously is not wasted but conducted away for use in the boilers.

The general appearance of the exhibition hall is wonderfully enhanced by the lavish employment of the electroliers, brackets, standards, etc., exhibited by Bergmann & Co., of New York. Two large floral electroliers, suspended from the roof amid Chinese lanterns, are in the very latest design and are choice specimens of artistic workmanship in brass.

Close to the band stand, Mr. F. A. Barr makes a special exhibit of the Edison light as applied to interior purposes for illumination and for decoration. He has a suite of three large rooms, beautifully furnished by Messrs. A. O. Skinner and J. White, local merchants, to represent bed-room, dining-room and parlor. In each the furnishings are most sumptuous and the electrical fixtures are put in to match; ceiling chandeliers, side lights, brackets and other details being shown. Mr. Barr has not been at all extravagant with the light, but has put in just enough lamps to show how thoroughly the incandescent can do its work, and be used where gas would not be permitted. These three bays have attracted large crowds and have been warmly admired by everybody.

On one side of this exhibit, and just beyond the Canadian Pacific telegraph office, Holtzer & Cabot, of Boston, have a nice display of their electrical novelties and specialties, including annunciators, burglar alarms, batteries, push buttons, etc., for houses, hotels, offices, etc. Passing to the other side of the bays, we find the attractive exhibit of the Thomson Electric Welding Company of Boston, in charge of Messrs. F. B. Royce and W. I. Brock. This space has been surrounded incessantly by large crowds eager to watch the process and secure sample welds. Two welding machines are shown in operation, one, the "automatic," which will handle the smaller sizes of copper wire, say from Nos. 12 to 18, and one that will easily deal with iron pipe of an inch bore. Both machines have created a profound sensation in this city, and nothing but repeated demonstration has overcome the incredulity felt by engineers, machinists and others interested in machinery and metal working. It deserves note that the welding generator supplying the current, on the floor below, is left entirely uncared for during the hours of running, a pretty good sign of its reliability. St. John has several industries in metal, and I shall not be surprised to learn that electric welding has been generally adopted for them after this excellent exhibition of what can be done.

Next to the Thomson welding exhibit comes that of Mr. James Hunter, a local electrician and dealer in electrical supplies. The space is ingeniously surrounded by glass insulators set on large pins. It embraces the exhibit of the Electric Gas Lighting Company, of Boston, for whom Mr. Hunter is agent, and whose apparatus has won a high reputation throughout the Dominion. This exhibit includes gas lighters, annunciators, burglar alarms, magnetos, medical batteries, etc. Mr. Hunter also shows a sewing machine operated by C. & C. motor and primary battery, and the Knudson & Ellsworth acoustic telephone for special telephonic work on short lines. Mr. Hunter also has charge of the Ball electric light exhibit, being local agent for the system.

Crossing over to the other side of the hall, the visitor next finds the fine exhibit made by the Brush Company, through Mr. Calkin, who is assisted by a bright young Brunswickian, Mr. O. B. White, who has been in training at the Cleveland factory. Mr. Calkin has the illumination not only of two large bays, but has furnished light and power to one or two adjoining exhibits, and being himself a St. John institution, the Brush Company having so long had its agency in the city, special interest is felt by the townsfolk in the display thus made. Along the front of the main aisle on his side, Mr. Calkin has a row of drop lights in variform and variegated shades. The two main bays are fitted up as the interior of a house by A. J. Lordly & Sons and H. Gilbert, and the apartments present a most brilliant ensemble, with their choice pictures, hangings, chairs, etc. Around the bays are fine photographs of the Brush factory in Cleveland, the Brush arc dynamo, the new Brush alternating generator, etc.; and an excellent portrait of Mr. C. F. Brush is also shown. Adjoining this exhibit are two fancy displays, one that of a coffee merchant and the other that of a candy manufacturer; and in both the Brush current is used to good effect for light and power. Near them, and also depending on Brush lamps for light is a milk shake or "twist" run by a small C. & C. motor on the Brush circuit. The visitors are not few who take an electric drink with curiosity and awe. The mill that grinds the coffee in the coffee booth is similarly run.

Fronting directly on the main floor, and next to the Brush exhibit, are the two handsome parlors of Mr. John Starr, of Halifax, the representative of the well-known European "ironclad" dynamo of Herr Lahmeyer. Mr. Starr is fortunate in having the only dynamo in operation on this floor, and the machine, driven from shafting on the machinery floor below, attracts a crowd of spectators all the time. The entire working of the apparatus is shown, as the switchboard, rheostat, etc., stand close by the machine in full view. The incandescent lamps run by the machine illuminate the bays inside and out, and 49 are also framed into the word "Starr" above the exhibit outside, in letters about two feet high. The furnishings of these bays were supplied by Manchester, Robertson & Allison, whose store is the "Macy's" or "Wanamaker's" of St. John, and who have spared no expense in making a gorgeous exhibit. The lamps used are those of the Sawyer-Man (Westinghouse) system, and give a pure, white light. The dynamo also supplies current to the C. & C. motor running the Æolian electric organ in the aisle.

This Starr exhibit also includes the efficient "Samson" battery, for which Mr. Starr has the agency, and the Law telephone system of the Federal Telephone Company, of Montreal. In fact, there is a complete telephone exchange in the exhibition, so that communication can not only be had with city subscribers, but among the exhibitors on the spot. Mr. Starr has a neat little board with 15 multiple connections, set up in one corner of his exhibit, and each of the other exhibits is supplied with a telephone station. Mr. Starr is exhibiting in connection with this board the new "Unique" telephone which, I understand, is now being introduced by the Federal Company in preference to the old Bell and Blake apparatus, on the ground of superior efficiency and economy. It is a compact little instrument closely resembling the Herz "push button telephone," illustrated in THE ELECTRICAL WORLD some time since. The microphonic contacts are made by seven small balls of carbon rolling loosely between two thin carbon discs, all being snugly boxed up.

Besides these leading exhibits, there are a great many smaller ones, of more or less interest. Thus in the gallery, in addition to the Edison fountain, is an excellent art department, illuminated by Edison lamps on a handsome Bergmann fixture. In the centre of the chamber is a bust of Morse, loaned by Mr. Joseph Wetzler, and a piece of the wire used by Morse in his first telegraph line, loaned by the *Century* Company, of New York, who had it from Mr. Stephen Vail, an autograph letter from whom, on the subject, accompanies it. Portraits are also to be found here of General Eckert and the late President Wm. Orton, of the Western Union Company.

All around the gallery are a number of Bergmann & Co. fixtures of beautiful design, and on one side is the exhibit of the H. B. Cox Electric Company, of New Haven, Conn. Special features of this exhibit are the gelatine battery and the medical battery, which have already been illustrated in the WORLD, and a neat little portable galvanometer. The mysteries of medical electricity have been probed here this week by a large number of persons with mingled wonder and merriment. In this gallery there is also a large, handsome device shown by Manchester, Robertson & Allison.

Among the miscellaneous exhibits may be mentioned the smallest sounder ever made—about an inch long and working nicely—sent by J. H. Bunnell & Co.; an old Morse relay, an early electric motor, and photographs taken by the electric light, sent by Dr. Vander Weyde; specimens of old and new ocean cables loaned by Mr. T. C. Martin; and an electric semaphore system shown by the Prince Edward Island Railway. There are also a number of exhibitors whose goods are now being laid out, or are on the way, such as the motors of the Sprague Electric Railway and Motor Company; Hibbard & Co., of Montreal, electric supplies; motors of the Robinson-Foster Company, of Boston; wires and cables of the American Electrical Works, of Providence, R. I.; batteries of the National Galvanic Battery Company, of Cleveland, O.; photographs of electric light and telegraph cables, shown by Middleton & Meredith; dynamos, etc., of the Canadian Electric Manufacturing Company, of Amherst, N. S., etc., etc.

It will be seen from the above that Mr. Knudson has managed to get together a very creditable exhibition, and it will also be noted with considerable satisfaction that American electrical manufacturers are prominent in all the various departments. This is decidedly as it should be, if the excellence of American products is to be as widely appreciated abroad as it deserves. The best way to secure foreign markets is to go after them.

I have already referred in detail to the lighting of the exhibition. It may be stated, however, that, all told, Mr. Barr is running about 600 Edison lamps, Mr. Calkin has about 200 Brush incandescents, large and small, and Mr. Starr has fully 100 Westinghouse lamps fed from his Lahmeyer machine. Mr. Calkin also does the arc lighting and has in operation a circuit of about 20 Brush arcs inside and outside the building. Hence, it will be seen, an admirable display of electric lighting of both kinds is given; while the ability of the alternating system is partially demonstrated in the Thomson generator that runs the welding plant.

Incidental to the exhibition are the visit of the British man-of-war "Tourmaline" and the fireworks. The "Tourmaline" has puzzled everybody by the ingenious handling of her arc search light, whose beams have been shot in every direction, suddenly lighting up the most distant points, and the display of fireworks has brought out other novel features of electrical work.

The exhibition will last until July 31, being open afternoon and evening each day, and it will be crowded with visitors to the close. No one can doubt the effect that it will have in stimulating electrical development in the maritime provinces and in Maine, from which, also, many tourists have come. The city has swarmed with visitors all the week, and the main topic of conversation with all has been the exhibition. In St. John itself, I believe that the first result will be the introduction of the incandescent light on a large scale. In fact, while chatting with Mr. Robertson, the dry goods

merchant, a man of most progressive and enterprising spirit, I found that he was only too willing and anxious for it, and his fine store alone would take 400 or 500 lights. St. John now has a handsome Brush station run by local capital and doing well, and the gas company has a Thomson-Houston arc plant also in good shape; but a large incandescent station is wanted, and I am confident it will soon be determined on, if, indeed, capital is not already pledged. Outside St. John, also, the openings are numerous, for the colony not only has fine water powers, but cheap coal, and her people though hitherto somewhat isolated are intelligent, pushing and persistent, ready to take their place in the van of progress, as exemplified by electric lights, electric street cars, telephones and telegraphs.

In conclusion I can only add that Messrs. Knudson and Cogswell, and those associated with them, deserve the heartiest praise for their hard work and for the brilliant success that, in spite of countless difficulties, has attended their efforts throughout. T. C. M.

The Kemmler Electrical Execution Investigation.

In the Kemmler reference before Referee Tracy C. Becker, Deputy Attorney-General Poste opened his case for the State on Monday, July 22. The first witness was Dr. A. D. Rockwell, a specialist in nervous diseases and electrotherapeutics, and professor in the New York Post-Graduate School. He believed that the application of an electric current to a man's body considerably lessened his resistance, and that, virtually, a man's resistance was no obstacle to the carrying out of any desired effect in the application of electricity. He found that in different men he got practically the same measurements when testing with the Wheatstone bridge. There might be some variation, owing to imperfection of contact, but in reality the electrical resistance of all men was very much the same. Witness believed unquestionably that an electrical current can be generated artificially which will kill a man instantly and painlessly in every case where it is scientifically applied; the electrodes could be so placed that he would not be burned, and they would require metal backs with a covering of sculptor's clay, or absorbent cotton, which should be moistened with a solution of sulphate of zinc or salt water. Witness was certain that 1,500 volts would kill instantly. The subject might possibly be burned if the application of the current were continued. The pathological effect upon the body of a fatal current would be a mechanical action upon the interior tissues; in fact, their rupture, the stoppage of the heart from paralysis of the nerve centres, and consequent cessation of respiration.

Unusual interest attached to Tuesday's hearing, as Mr. T. A. Edison was placed on the stand, and testified on behalf of the State. Mr. Edison was particularly questioned on the subject of the resistance of the human body. Mr. Edison gave it as his opinion that the accuracy and reliability of the Wheatstone bridge for measuring the resistance of the body was absolute, and that on the previous Saturday, knowing that he would be called on to testify in this case, he experimented on 220 of his workmen for the purpose of determining their resistances.

The result was an average measurement of 1,000 ohms, the resistance varying from 660 to 1,800 ohms. Mr. Edison then minutely described the manner in which the tests were made. He did not in the least question the fact that some parts of the human body showed a resistance of 200,000 ohms. Dirt or oil on the surface subjected to the electric current materially increased the resistance. If there was burning, it was evident that the contact was imperfect, and that a reduced quantity of current passed through the body.

Under cross-examination by Bourke Cockran, the witness stated that at the first contact of the current the resistance was proportional in a large degree to the area of the electrodes. Whatever the resistance might be, about 15 per cent. of it would be met with at the point of contact, and the remainder through the body. Imperfection of contact had a very considerable effect on the resistance.

Mr. Edison stated that Mr. Harold P. Brown had no connection with the Edison Company; he had never given Mr. Brown a letter of introduction to anybody; had no recollection of writing a letter to Mr. Johnson in which the words "It would be as well to put Brown on the job," or words to that effect, were used. Mr. Cockran did not press the question, although he appeared to quote from a letter he held in his hand. The Zipernowski system of distribution, witness stated, was controlled by the Edison Company, but it was not in extensive use. Mr. Edison did not think well of it. The witness also affirmed that the electric current could be applied to the human body by artificial means in such a manner as to produce in every case instant and painless death. The form of electrode recommended by Mr. Edison for applying the current in criminal execution was a jar of water with dissolved caustic potash. The criminal's hands should be placed in two such jars, and 1,000 volts would be sufficient to produce painless death in all cases. That result, however, could not be reached with the continuous current, the current necessary being the alternating current or the interrupted continuous current. The continuous current did not seem to have much effect on the nerves; 8 volts of it could be given to a subject, and he could not feel it, while 3 volts of the alternating was as much as Mr. Edison cared to stand. Mr. Edison had made experiments with a galvanoscopic frog, for the purpose of ascertaining the effect produced on muscular tissue by the application of an electric current. He took a frog's leg and connected it with a wire running from Washington to New York. By the twitching of the muscles, he was enabled to receive a telegraphic communication from that city without the aid of a sounder. That was produced by the intermittent current.

Mr. Edison calculated that about $\frac{1}{1800000}$ of an ampère was used. In the experiments he had undertaken, Mr. Edison had found that there was a strong rush of water through the pores, and that in the passage of the current through the human body the water would be forced through all the tissues. Being told by counsel that Mr. F. L. Pope had testified that sufficient current, if passed through a man's body, would carbonize it from one end to the other, in fact burn it to a crisp, Mr. Edison said he did not see how it was possible.

The rest of Mr. Cockran's cross-examination of the witness failed to evoke anything in addition to the testimony given on Mr. Poste's examination.

Mr. A. E. Kennelly then took the stand, and detailed at length the results of the experiments made on dogs, horses and calves at the Edison laboratory. Compared with some of the figures of Mr. Harold P. Brown, they showed some discrepancies, and the point was taken up promptly by Mr. Cockran.

Dr. Cyrus Edson, physician in chief to the Board of Health, and president of the New York Board of Pharmacy, was the next witness. He spoke of the dogs which had been experimented on; these were three in number, weighing from 53 to 91 pounds each. From 225 to 250 volts of the alternating current were used. All the dogs except one were killed instantly. The one that was not killed at the first shock survived because the voltage was very low. They found that 250 volts would kill instantly. The rest of the evidence was confirmatory of what had been testified to by other witnesses for the state.

The investigation was adjourned to be resumed in Buffalo on July 31.

Itinerary of the Special Train to the Niagara Falls Convention.

For the accommodation of the delegates from New York State, the special Pullman train, which will leave the foot of Chambers street, New York, for Niagara Falls, at nine o'clock A. M., Monday, Aug. 5, will stop to take on passengers at the following points: Port Jervis at 11.40 A. M., Susquehanna at 2.50 P. M., Binghamton at 3.30 P. M., Owego at 4.20 P. M., Elmira at 5.05 P. M., Hornellsville at 6.40 P. M. and East Buffalo at 9.25 P. M.

Gentlemen and their ladies who find it more convenient to board the train at the above-named points can do so by sending one dollar and a half, to cover their Pullman seat, to the headquarters of the National Electric Light Association, 18 Cortlandt St., New York, or to the office of THE ELECTRICAL WORLD.

A Rehearing Denied in the Accumulator Case.

After the rendering of the decision of Judge Coxe* in the suit of the Electrical Accumulator Co., *vs.* The Julien Electric Co., *et al.*, a rehearing was asked for by the Julien Electric Co., which was demurred to by the complainants. In denying the petition for a rehearing last week, Judge Coxe says:

A rehearing is asked upon the following principal grounds:

First: The court was in error in holding that the patent, as limited by the disclaimer, discloses invention; for the reason that an electrode to which the active material is applied in the form of a paint, paste or cement has no advantages over electrodes otherwise mechanically coated. This proposition the defendants seek to establish by further experiments and by the opinion of experts.

Second: On the ground of newly discovered evidence.

Third: Because the complainant should not have been permitted to file a disclaimer.

When this enormous record was taken up for examination, the Court confidently entertained the conviction that it presented a controversy in which nothing relevant to the art in question, which human ingenuity and diligence could supply, had been omitted, and that no proposition of law or fact, actual or contingent, had been neglected or unexplained. Where time and labor have been so lavishly expended, where the presentation of the cause has been so thorough, and where every opportunity has been offered counsel to present their views, the Court should be unusually reluctant to reconsider a conclusion deliberately reached. The administration of the law will become vexatious and intolerable if, upon slight pretexts or unsubstantial grounds, parties are permitted, because the decision changes to some extent the nature of the controversy, to try again and again issues which were, or which might have been, disposed of at the hearing.

The notice that a disclaimer would, in certain contingencies, be insisted upon, was unusually full and explicit. It was suggested by the proof, and at the hearing the defendants were clearly advised that a disclaimer might be necessary, the complainant even going so far as to suggest its form. The question was orally argued. It was again discussed in the learned and comprehensive brief submitted by the defendants, and the right to file a disclaimer was strenuously controverted. And yet, during all this time, it was never intimated, as the facts are now recalled, that the record did not sufficiently present the question. That position was taken for the first time after the decision was filed; nearly five months from the time that actual notice of the proposed disclaimer was first given.

The affidavits attached to the petition contain the opinion of several scientific gentlemen to the effect that the first ground for rehearing is well founded. No new facts are presented, except in one instance, and their verity is denied by two affiants for the complaint. Moreover, it appears that, upon this proposition, the complainant's experts absolutely disagree with the defendant's experts—a situation not wholly novel in patent cause. If, therefore, the application were granted, it is altogether probable that after the parties had been put to the trouble and expense of producing another volume of opinions, the Court would be constrained to reach the same result as before. The very question now presented was at that time carefully considered; it was thought then, and it is thought now, that Faure's electrodes have certain characteristics, so plain that no scientific testimony is necessary to emphasize them, which distinguish them from preceding structures, and that there is room enough in the art for his restricted invention, even after giving Mr. Brush full credit for his experiments.

If it be true that Faure's batteries are inferior to, or no better than, others, the question naturally suggests itself: Why are not the defendants content to use the other batteries?

The injunction can do them no harm, and if they can establish their position before the master, it is not easy to see how they can be seriously injured by an award of damages. The anxiety displayed to use Faure's invention is surely incompatible with the theory that other supports are as good as, or better than, his.

Regarding the Pulvermacher patents, it may well be doubted whether a sufficient excuse has been presented for not having before offered them in evidence; but even were this otherwise, it is entirely clear that they contribute no new fact to the art. It is not pretended that they relate to secondary batteries. What they show as to primary batteries was sufficiently demonstrated before. The subsequent patents granted to Faure may be invalid because of the patent in suit. But, even were they properly in evidence, it is not easy to see why the patent in suit be invalidated, or a disclaimer refused, because of them.

After an examination of the authorities upon the question of disclaimer, no precedent is found for the practice now suggested by the defendants. The usual course has been followed in this cause. The defendants have had a fair hearing. To open again, in this court, the door of disputation would be unjust to the complainant. If the defendants deem themselves aggrieved their remedy is by appeal.

A rehearing is denied.

* See THE ELECTRICAL WORLD, March 30, 1889.

A New Contract between American Bell and Erie.

The board of the Erie Telephone Company completed negotiations on July 25 with the American Bell Company for a perpetual contract for Cleveland and Southwestern companies on a basis entirely satisfactory to both parties. This gives the Erie a perpetual right for the entire territory. The terms of the contract for all three sections are as follows: Northwestern Telephone Exchange Company—American Bell to own 30 per cent. of the stock, Erie 70 per cent., American Bell Company waiving participation in dividends until Jan. 1, 1890. Cleveland Company—American Bell will own 35 per cent., Erie Company 65 per cent., American Bell waiving participation in dividends until Jan. 1, 1890. Should special funds above earnings be required for new construction or underground work, the American Bell will contribute 35 per cent. toward costs. They will also contribute 35 per cent. toward the cost of the new Cleveland switchboard, which has already been paid for by the Erie. Southwestern Company—American Bell will own 30 per cent. of stock, Erie 70 per cent., and Bell waiving dividends until June 1, 1891. The American Bell Company also makes the Erie a handsome cash concession. The average per cent. of the stock for the entire perpetual contract is 31⅓, based upon present earnings of company, 4 per cent. The dividends can be maintained after the American Bell participates in 1890. Should the company not increase its earnings one dollar, the dividend paid in November, 1891, after the American Bell proportion participates in Southwestern section, would be at a rate of 3½ per cent. With the present rate of increase of new business, the Erie stockholders are assured 4 per cent. regularly, beside accumulation of surplus.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-177 TIMES BUILDING, NEW YORK, July 29, 1889.

The Jerome Avenue Railway Company has been formed, to operate from Macomb's Dam Bridge to WoodlawnCemetery. The capital stock is $200,000. The use of electricity is proposed. Several well known men are interested.

Mr. John I. Sabin, of San Francisco, has arrived in New York, and is staying at the Electric Club. His presence in the East will be a source of great pleasure to his friends, and he will never be forgiven if he goes away before the "clambake of the year."

The Safety Light and Power Company have commenced the erection of their extensive station in New York City. They will operate the Westinghouse alternating system, and have contracted for six Westinghouse compound engines, each of 150 h. p.

The Abendroth & Root Manufacturing Company report the sale of two boilers of 175 h. p. each, also one of 140 h. p., to the Jersey City Electric Lighting Company, making a total of 490 h. p., and being in addition to its present plant of 490 h. p., giving total Root boilers in this plant of 980 h. p.

Mr. Frank Chinnock, the Edison agent, has recently been enjoying great success among the mill owners of Long Island and Jersey, and now has secured a fat contract for the plant to go in the big Clark thread works at Kearney, N. J. The plant is necessarily a large one, and it is to be installed immediately.

The Westinghouse Machine Company, of Pittsburgh, Pa., report that their business is unusually active for this season of the year. Their sales during the months of May and June were simply phenomenal, and the outlook for the continuance of such sales is good. The orders received by them for the first twenty days of July, amount to 48 engines, footing up to over 3,000 h. p.

Mackay-Bennett Launch.—The famous naphtha launch, constructed by the Naphtha Launch Company, to be used in the work of keeping that part of the Mackay-Bennett cable in the vicinity of Canso, Nova Scotia, in first-class condition, was launched last week from the company's dock on the Harlem River. The craft is a model of its kind, and was christened the "Marie Louise" in honor of Mrs. Mackay. Quite a notable company was present at the ceremony.

Mr. E. B. McClees, the general agent for Kerite, 16 Dey street, I found busy at his desk last week dictating a number of large orders to his amanuensis to be sent to the factory at Seymour, Conn. Some of the orders struck me as pretty heavy, but Mr. McClees takes them quite as a matter of course, although they run into thousands of feet and thousands of dollars. Kerite is evidently just as popular as it ever was.

The Empire City Electric Company is now putting on the market a new insulated overhead wire which possesses a number of valuable properties. It is covered with two layers of braiding and is proof against weather, water and fire. I applied a match to the wire and found that it had no effect whatever upon it. Large orders have already been taken for it, and the "W. W. F." wire, as it is called, will no doubt be in great demand.

The Law Battery holds its own in spite of the many new competitors that spring up from time to time. As the Law Telephone Company says, it has stood the test of eight years, and has won new laurels at every stage. In its latest form it has more friends than ever, and has a practically limitless term of existence. At the home office, 112 Liberty street, good sales are reported, and Mr. M. M. Haydon is now doing excellently on the road in New England.

The American Electrical Works, of Providence, R. I., entertained a number of the insulated wire manufacturers, I hear, at the Pomham Club, on Thursday, July 18. It is needless to add that President Eugene F. Phillips played the part of host, as usual, to perfection. Among those around him were T. L. Scoville, H. L. Shippey, John Wallace, C. H. Cone, R. Knight, P. C. Ackerman, W. H. Sawyer, W. H. Hathaway and Mayor Barker.

Mr. John W. Mackay spent an evening last week with about a score of the members of the Commercial Cable staff. They descended upon him unexpectedly at the Windsor Hotel, bearing a unique album as a gift to him. In the album were pen drawings of

characteristic scenes in every city where his cable co mpany has an office. There was a little speech-making and a good deal of cork popping, and Mr. Mackay and the party had a most delightful evening.

Mr. Charles Theberath, 10 and 12 Ward street, Newark N. J., has a fine brass foundry, where he is paying special attention to brass, copper, composition and aluminium castings for electrical work. Mr. Theberath is deserving of encouragement for the manner in which he has studied to meet the requirements of this branch of the business, and his facilities are so superior that they would be very hard to surpass. He is engaged on work in connection with telegraphy, telephony, dynamo and motor building, etc., and on metal work also for household electrical apparatus.

The "C. & C." Electric Motor Company were for some time known only as makers of small motors, but their success in this direction, coupled with the increasing demand for large motors and their new facilities for manufacture, induced them to turn their attention to this wider field. With what result may be inferred from the fact that during the last four months upward of one hundred horse-power of motors, in sizes ranging from 1 to 20 h. p., have been placed in New York City alone. In Chicago, Boston and the other important cities, east and west, the results have been equally gratifying.

The Complete Electric Construction Company, 18 Cortlandt street, W. G. Sellers, general manager, have lately furnished the equipment of a large arc light plant of the new American system at Dobbs' Ferry on the Hudson. The plant comprises 40 lights and 15 miles of wire on poles. They have also recently completed the installation of 6,000 incandescent lamps for the Safety Electric Light and Power Company, formerly the United States Illuminating Company. Another nice piece of work has been the putting underground in New York of 15 miles of cable made by the New York and New Jersey Telephone Company, at the works, 129-131 Water street, Brooklyn.

The Denver Consolidated Electric Company have placed an order for two 200 h. p. Westinghouse automatic compound engines. Some four months ago, they contracted with Fairbanks & Co., of St. Louis, Mo. (agents for the Westinghouse Machine Company), for a Westinghouse compound engine of 125 h. p., which engine Fairbanks & Co. guaranteed would show a water consumption not to exceed 25 pounds per indicated h. p. per hour. The engine was duly shipped, and after being set up and run a short time, a test was made, in order to ascertain the fuel economy. The test showed the water consumption to be less that 23 pounds per indicated h. p. per hour. On this showing, the Denver Consolidated Electric Company awarded the contract for their additional steam power to Fairbanks & Co., for two 200 h. p. Westinghouse compound engines, as before stated.

Remarkable Economy in Fuel.—The Chicago office of Westinghouse, Church, Kerr & Co. has made a remarkable showing in the line of economy, at the Aurora Electric Light and Power Company, Aurora, Ill. The original plant of this company consisted of a horizontal return tubular boiler with a good automatic engine, heater, etc., burning the best quality of lump coal, which was found to be necessary under the conditions, at an average cost of from four to five dollars per night. This plant was replaced by a Hazelton boiler fired by two Roney mechanical stokers, and a Westinghouse compound condensing engine. The company immediately went to buying the cheapest quality of slack coal, with an enormous reduction in the quantity burned. The net result, running exactly the same number of lights and for the same time, was a reduction of from $4.50 per night, to 90c. per night.

The Clark Electric Company have now settled in their handsome new quarters in the Corbin building, recently constructed at the corner of John street and Broadway. They are on the top floor, whence their windows overlook New York Bay, and they revel in cool breezes, which seem to play continuously there through the hottest days. Mr. J. H. Seymour, the president of the company, Mr. A. B. Benjamin and Mr. E. P. Clark, the electrician, are all comfortably located, and are inclined to work with more energy than ever. Mr. Clark has, in fact, done remarkably good work of late in perfecting his arc light system, and he has good reason to be satisfied with the tests on his method of automatic regulation, as well as on his new arc lamp—all of which you recently described and illustrated. Without any great flourish of trumpets, but with steady work, the Clark system is gaining a solid foothold and daily extending its territory.

Electric Motors for Organ Use.—Not the least among the many uses which electricity now subserves is its application through the medium of motors to the operation of church organs. The C. & C. Electric Motor Company is especially well equipped for this work in the person of Mr. William Chester, who is connected with it, and who is also an organist of high reputation, thoroughly familiar with the mechanism and construction of church organs as well as with the electrical details required for their operation. The C. & C. Electric Motor Company have now placed their motors in St. Paul's Church, St. Patrick's Cathedral, the Collegiate Reformed Church, and the Madison Square Church, and contracts have been signed for similar installations in Trinity, St. Thomas, Calvary and St. Ignatius churches. This list represents the company's work in New York only, and from it it will be seen that the C. & C. Company have a practical monopoly of the organ work here. The first motor for this use was set up in the historical St. Paul's Chapel, in Trinity parish. The corporation of Trinity were skeptical, and it was only after the most thorough tests that the motor was pronounced a success. Once, however, this was established, the corporation instructed the company to make a similar installation, but of greater magnitude, in old Trinity, and in the meantime churches of all denominations had followed the example set by St. Paul's. The advantages of the electric motor over other means of pumping the bellows are so evident that it is only a question of a short time before all churches within reach of electric current will be provided with this appliance. Henceforth the organist is independent of the pleasure of the organ blower or the vagaries of the gas engine; he seats himself at his instrument, touches a button within easy reach of his hand, the motor revolves, the bellows rise and fall, and the organ, obedient to his touch, gives forth its rich tones. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, cor. Franklin and Congress Sts.
BOSTON, July 27, 1889.

North Billerica.—The Talbot Mills are to be lighted by electricity.

Mr. J. C. Pierrez, of the Goodrich Hard Rubber Company, was in Boston this week.

Mr. George T. Manson, of Okonite fame, was also visiting his numerous friends in the city this week.

The Woburn Electric Light Company has increased its capital to $100,000 and is earning 7 per cent. on its capital.

Mr. James Goldmark, of Wallace & Sons, who spends a few days every month in Boston, was a caller at this office during the week.

Swampscott, Mass.—This beautiful summer resort has lately been much improved by the introduction of electric lights into some of its main thoroughfares.

Salem, Mass.—At a meeting of the Salem City Council permission was unanimously granted to the Naumkeag Street Railway to run electric cars on their road.

Dedham, Mass.—The Dedham & Hyde Park Gas and Electric Light Company has appealed to the Gas Commissioners against the granting of the franchise to the Dedham Electric Company.

The Boston & Albany Railroad will light its new depot in Springfield with the Edison system, with two 65 h. p. Westinghouse compound engines, coupled directly to the shafting.

Brookline, Mass.—The Selectmen have been petitioned by the West End Railway for permission to establish and maintain the overhead system of electric cars on the streets of Brookline, wherein its tracks are now located.

The Westinghouse Company has been granted a franchise in Grafton. The intention is to furnish lights for Grafton, Upton, West Upton, Farnumsville, Fisherville, Saundersville and North Grafton, Mass. The plant will cost about $50,000.

North Adams, Mass.—The Gas Commissioners will give a hearing on the petition of the North Adams Gas Light Company for permission to furnish electric lights, which is opposed by the North Adams Electric Light and Power Company.

Lowell, Mass.—The directors of the Lowell Horse Railroad Company are considering the advisability of erecting a station for an electric plant, on the site of the stables recently burned down, so that they can run their cars hereafter by electricity.

Pettingell, Andrews & Co. continue to do an enormous trade in their K. W. Rosette Cut-Outs, made both in cherry wood and porcelain. The index which I take for the popularity of this cut-out is the steadily decreasing quantity of the little boxes in which these goods are shipped.

Lowell, Mass.—Two of the tow cars to be used on the electric railway to Willow Dale have arrived. Several of the electric cars and several additional tow cars are expected to arrive in the next few days. The rails are all laid and the overhead wires strung to within a short distance of the Dale.

Dr. A. De Bausset's Air Ship.—A company has been organized in Boston to aid in building the steel air ship of Dr. De Bausset. Permission has been sought to build the ship in the Charlestown navy yard, and a national subscription will be made to defray the expense, which is estimated at $225,000.

The Newton and Watertown Gas Light Company will erect a brick building with granite trimmings, 80x100 feet, in which they will place their electric light plant. The building when completed will cost about $12,000. Ground will be broken at once, and they expect to have the building ready to move into in six weeks.

The Worcester Electric Company has voted to increase its capital from $125,000 to $200,000. The increase was made to provide for the new land recently purchased, a new building, and new improved machinery. The directors have already plans for a fine new electric light plant, equipped with the latest improved machinery.

Lowell, Mass.—Conduits are being laid in the principal streets of this city by the New England Telephone and Telegraph Company for the burying of its wires. About 40,000 feet of wrought iron pipe, 3 inches inside diameter, manufactured by the National Tube Works Company, of Boston, is being used, solidly laid in a bed of concrete.

White River Junction, Vt.—At the annual meeting of the stockholders of the Vermont & Boston Telegraph Company, held July 24, the following directors were chosen: Norvin Green, Thos. T. Eckert, Chas. A. Tucker, R. H. Rochester, of New York; Thos. Roche and Henry C. Sherman, of Boston, and R. J. Kimball, of West Randolph, Vt.

Somerville, Mass.—At the last regular meeting of the season of the Somerville city government, the committee on street lighting was authorized to make the contract with the Somerville Electric Light Company to light the city with 140 arc and 275 incandescent lights for three years. This is an increase of nearly 150 lights over last year's contract with the same company.

Newport, R. I.—The Edison Electric Illuminating Company, of Newport, have found that their rapidly increasing business has made it necessary to about triple the capacity of their station. They have ordered from the Jarvis Engineering Company two Armington & Sims engines, of 250 h. p. capacity, and are having their new boilers set by the same concern with the Jarvis furnace.

Bangor, Me.—As an auxiliary to the water power, which is at present being used in Bangor for the municipal plant, the Hon. C. F. Bragg, Mayor of the City, has ordered from the Jarvis Engineering Company of Boston two horizontal tubular boilers, set with the Jarvis patent furnace. This company will also furnish the engine, of the Armington & Sims type, which will effectually provide against any temporary derangement of the water-wheels during high tides.

The Thomson European Welding Company, it is rumored, will not manufacture its machines in Lynn, but will establish factories in five European countries. This movement is made imperative in order to hold patents in those countries. At West Lynn several machines are in process of manufacture for foreign shipment. Work will be immediately commenced in the erection of factories in foreign countries, and it is hoped they will be in operation within three months.

The Thomson-Houston Electric Company have recently closed new contracts with the following street railways: Passaic Street Railway, Passaic, N. J., 3 miles, 3 cars; St. Louis Bridge Company, St. Louis, Mo., 2 miles, 4 cars; Ottumwa Street Railway Company, Ottumwa, O., 5 miles, 4 cars; Georgetown, Tenalley Town Street Railway Company, Washington, D. C., 3 miles, 6 cars; Victoria Electric Street Railway Company, Vancouver Island, Victoria, B. C., 4 miles, 4 cars; Saratoga Electric Railway Company, Saratoga Springs, N. Y., 2 miles, 4 cars.

The Wheeler Reflector Company have recently received large orders from the Thomson-Houston Electric Company and the New England Weston Electric Light Company for their lately introduced enamel shades, style 301 in their catalogue. These little shades are meeting with deserved success, as they are gotten up in a neat and strong manner, and are eminently adapted for factory use, where something inexpensive is required. Mr. Wheeler is now getting up his stock of reflectors for the fall trade, and many of them are very beautiful and tastefully designed. For church and hall use they are unexcelled, and are indeed an ornament to any building.

The Jarvis Engineering Company.—I am informed by the Jarvis Engineering Company, agents for the Armington & Sims engine, that they are selling a large number of engines of this well-known manufacture. Among their recent orders are the following: Consolidated Electric Light Company, Portland, Me., one 90 h. p.; Edison Company, Boston, Mass., five 135 h. p.; Edison Company, Newport, R. I., one 80 h. p., and one 35 h. p.; Bijou Theatre, Philadelphia, one 50 h. p., City of Bangor, Me., one 135 h. p.; Bridgeport Electric Light Company, Bridgeport, Conn., one 90 h. p.; North Shore Electric Light Company, Beachmont, Mass., one 400 h. p.; Eastern Electric Construction Company, Portland, Me., two 125 h. p.; Steamer "Kennebec," one 40 h. p.

The Municipal Signal Company have just secured a good order for equipping the city of Newark, N. J., with their complete system of police call boxes. Their bid, though not the lowest, was successful, the general opinion being that, though the cost was greater, yet the system was cheaper to operate and maintain. The specifications call for 100 boxes, each capable of giving six alarms, three of which are silent for duty signals, being automatically registered at the station house. The remaining three are audible, one for police wagon, one for citizen's fast wagon and the third for telephone one, by which any officer can speak to the station.

The North Shore Electric Railroad.—As a sample of the great capabilities of a well-managed electric railroad, it may be interesting to your readers to note that two cars on the North Shore Electric Railroad from Crescent Beach to Winthrop Junction, Revere, Mass., using Thomson-Houston apparatus, carried last Sunday, in the space of about eight hours, no fewer than 4,908 passengers. The length of the road is about two miles, and there are two 7 per cent. grades to be overcome. The two conductors of the cars took in on Sunday the nice little sum of $237.45, and Mr. Benedick, the president of the road, is anxious to hear of any other road, electric or otherwise, which can show as good statistics for one day's run.

The New England Telephone and Telegraph Company.—The following is a statement of business for the quarter ending June 30, 1889:

Gross receipts for three months ending June 30, 1889	$324,707.20
Expenses " " " "	230,893.20
Net earnings for three months ending June 30, 1889	$ 93,814.00
Construction for three months ending June 30, 1889	$ 17,923.98

At a meeting of the directors of the company, held July 24, a dividend of 75 cents per share was declared, payable on Thursday, Aug. 15, 1889, to stockholders of record at the close of business on Wednesday, July 31, 1889. The transfer book will be closed from Aug. 1, 1889, to Aug. 14, 1889, both days included.

The Southern New England Telephone Company has completed a metallic circuit or double-wire trunk service throughout its territory in Connecticut. The new service is similar to the long-distance service now in use throughout the country, and differs from the old system of grounded circuit in that the connections are made over a pair of wires looped together instead of connecting on a single grounded wire. The results are, of course, materially better than over the old style of grounded circuit. The company is looking for a permanent location in Hartford, and will purchase a site there as soon as a desirable one can be found. The change will be made with the view of undergrounding the wires for most of the service in the city. It will arrange for 3,600 buried wires at the outset, but the improvement will not probably be effected before next year.

Special Excursion to Niagara Falls.—Dr. Austen has organized a very pleasant trip of a week's duration, with the double object of attending the convention of the National Electric Light Association at Niagara Falls and of viewing as much of the beautiful scenery on the return home by Canada as can be seen in a few days. The excursionists will leave Boston on Monday, Aug. 5, at 8 A. M. by way of Rutland, Vt., and arrive at Niagara Falls at 9.45 on Tuesday morning. Leaving Niagara Falls on Friday, the party will return by Toronto, Alexandria Bay (Thousand Islands) and Montreal, reaching Boston early on Monday morning. This trip has been specially gotten up for gentlemen intending to take ladies, and everything will be done to relieve the visitors of the cares of traveling. The entire cost of the trip will be $34, and further information can be procured from Dr. G. L. Austen, 620 Atlantic avenue, Boston.

The Thomson-Houston Electric Company reports the following sales of central station plants: Springfield, O., 1,300 inc.; Brunswick, Ga., 50 arc; Paterson, N. J., 650 inc.; Nantucket, Mass., 18 arc, 500 inc.; Lee, Mass., 650 inc; Memphis, Tenn., 1,300 inc.; Palmer, Mass., inc; Eufaula, Ala., 50 arc; Great Falls, N. H., 200 arc; Portsmouth, N. H., 500 inc.; Kattskill, N. Y., 650 inc., 30 arc; Natick, Mass., 1,300 inc.; Bellaire, O., 70 arc; Canandaigua, N. Y., 650 inc.; Athens, O., 50 arc; Citizens Co., Brooklyn, N. Y., 135 arc; St. Joseph, Mo., 100 arc; Chattanooga, Tenn., 100 arc; Montclair, N. J., 30 arc, 1,300 inc.; Baltimore, Md., 1,000 inc. They also report the sale of the following isolated plants: Julius Saul, Albany, N. Y., 20 arc, 100 inc.; Providence Steam Engine Company, Providence, R. I., 30 arc; Spencer House, Niagara Falls, 200 inc.; Rodman Manufacturing Company, Lafayette, R. I., 800 inc.; Bennett Manufacturing Company, New Bedford, Mass., 800 inc.

Electric Gas Lighting Co.—Col. Burnham is now prepared to furnish an automatic electric gas lighter and extinguisher, which he claims is an important advance in the art of lighting gas by electricity, and which he has termed the "Triumph Automatic No. 12." A great deal of time has been spent on this burner, and Colonel Burnham is to be congratulated upon the success which has capped his labors in this line. Only one wire is required from battery to button, and button to burner, and a single push button is used both to light and to extinguish the burner. Two of these Triumph automatics can be placed on a fixture wired for one automatic; and wires for pendant burners can be utilized by simply connecting in a push button between battery and burner. Its operation is positive the electric impulse being sure to leave the gas valve either wide open or entirely closed. It is a third smaller than automatic burners heretofore in general use, and costs considerably less. All electric fitters should investigate this burner, as the device is so neat and its action so sure and perfect that it must recommend itself to all who can appreciate what a really good automatic lighter and extinguisher is.

S. S. "Minia."—I took advantage of the presence of this well-known cable steamer in Boston Harbor to pay her a visit, and was very kindly entertained by Captain Trott and his officers. Chief Officer Newton, Navigating Officer Hicks, Electricians Hamilton and Stott, all so well known to many of the electrical fraternity in New York, Boston and elsewhere, were on board and looking well after their recent Atlantic voyage. It was a matter of unusual pleasure for me to find Mr. Stott on board, as we were old college friends, both being disciples of Professor Andrew Jamieson, now resident in Glasgow. Capt. Trott's son has been left at London, where he intends taking a thorough course in electrical engineering. The "Minia" left London on April 28 and arrived in Boston Harbor on July 13. Between Newfoundland and Boston eight repairs have been made, most of them on separate cables. The "Minia" has not many idle days, as she has fully 19,000 miles of cable to look after, and has only spent one week in port since leaving London. During this time Capt. Trott laid over 300 miles of new cable and picked up over 200 miles of old. The "Minia" left Boston July 20 for Halifax, whence she will proceed immediately to the mid-Atlantic to repair a break in the 1869 Brest-St. Pierre cable, which is broken in 2,000 fathoms of water. It will probably take a month to make the repair and return. A. C

PHILADELPHIA NOTES.

Branch Office of The Electrical World,
31 City Trust Building, Philadelphia, Pa., July 27, 1889.

Bedford, Pa., has started its new electric light works and the authorities are very much pleased with it. There are 600 incandescent and 50 arc lights on the circuits.

A 60-light Arc Plant has been placed in the large dry goods store of Sharpless Brothers, at Eighth and Chestnut streets, by the Thomson-Houston Electric Company.

Walker & Kepler, electrical constructors, have secured the contract for installing a 10-light arc dynamo in the big sugar refinery of Harrison, Frazer & Co. The Thomson-Houston system will be used.

Mr. Chas. O. Baird, president of the Thomson-Houston Electric Light Company, sailed for Europe last week. His trip will consume several months, and will be divided among all the chief places of note both in England and on the continent.

Electric Cars.—The Electric Car Company, of America, expect to have cars running on the Lehigh Avenue branch about Sept. 1. Work on the road bed is rapidly progressing. The Wharton system of storage cars will be employed in connection with the Gibson battery.

Mr. V. J. Mayo, inventor of the Mayo dynamos and motors, manufactured by Clark Brothers, of Belmont, N. Y., arrived in this city last week on a short business trip. Mr. Mayo is at present installing a plant at Merchantville, N. J., using his own type of machine.

Mr. A. F. Moore, the well-known manufacturer of insulated wire, reports business as very active, principally in waterproof line wire. There is also a good demand for magnet and armature wire, which this house manufactures in sizes from No. 0 to No. 40. They also make a specialty of rubber-covered wires.

The Novelty Electric Company are very busy at present getting up drawings and plans for the complete manufacture of electric motors, dynamos and incandescent supplies of all kinds. They are the general agents for the Ball Electric Light Company, and the Philadelphia agents for the Gibson storage battery and okonite wire.

Messrs. Walker & Kepler, the Edison agents and contractors of this city, have been awarded the contract for wiring the Aldine Hotel in this city for 920 16 c. p. lights. The current will be taken from the Edison central station. Should the hotel desire to put in its own plant later, the contract calls for an Edison plant complete for 900 lights at any time it is wanted.

Tarentum, Pa.—The local electric light company has awarded the contract for furnishing a 600 incandescent light plant to the Thomson-Houston Electric Light Company, of this city. The alternating system of this company will be installed. There were quite a number of bidders, all of whom were eager to put in their own system, and the contract was delayed on that account.

Reduced Prices for Electric Lighting.—At the recent meeting of the Philadelphia Edison Lamp Company, on the initiative of Prof. W. D. Marks, the cost of light from the Edison circuits was reduced to three-quarters of a cent per lamp hour. This brings the cost of electric lighting down to that of gas, which at present is $1.50 per 1,000 feet. The reduction will unquestionably be followed by a large increase in the business of the company, which even under the old rates was growing steadily.

Moorestown, N. J.—The local company have contracted for two 500-light incandescent dynamos, of the alternating current type, and for two 60 h. p. Westinghouse engines, both contracts being secured by Mr. J C. Cloud, the representative of the Thomson-Houston Electric Company. The contest was narrowed down to a few companies as the specifications called for alternating dynamos, but the competition was clean cut and sharp. Work will be begun as quickly as possible, and every endeavor will be made to complete the installation in less than three months.

Daft Railway for Sunbury, Pa.—The Daft Company has secured the contract to equip by electricity the Sunbury & Northumberland Railway. They will put in immediately three motor cars, each of which will be able to tow an additional car. The company will also install the steam plant, generator, etc., all of which will be under the supervision of Mr. T. B. Abercrombe, superintendent of the Sunbury division of the Pennsylvania Railroad. The road will be 3¼ miles in length, and will be used to transfer all passengers and express matter between the Pennsylvania Railroad and the Reading Railroad. The road is intended to take the place of the present steamboats between the cities of Sunbury and Northumberland. Mr. Henry R. Davis, a prominent owner of coal mines in this district, is the president of the road, and Senator Wolverton is also interested.

Messrs. James W. Queen & Co. have just received large consignments of Ayrton & Perry's celebrated ammeters and voltmeters. There has been such a demand for these instruments that Messrs. Queen & Co. have heretofore received more orders than they could fill from stock. However, now that the manufacture of the Ayrton & Perry instruments has been placed in the hands of a new and large English house, it is hoped that with the increased manufacturing facilities the supply will be equal to the demand. In addition to the Ayrton & Perry instruments, Queen & Co. report that they are having a brisk demand for the Cardew voltmeters, Siemens electro-dynamometers and Carpentier ammeters and voltmeters. Professor Anthony's resistance sets are already being recognized as standards.

Media, Pa.—The Media Electric Light and Power Company has awarded the contract for furnishing a 35-arclight plant complete to the Fort Wayne Jenney Electric Light Company, represented by Mr. G. F. Wilbur. For the incandescent plant, the Westinghouse Company, represented by Mr. Charles F. Bragg, received permission to install two 500-light alternating current machines. The continuous current people, it is stated, were debarred from bidding for the installation on account of a clause in the specifications which especially called for the alternating system. It is said that the steam plant was also secured by the Westinghouse representatives, but this has not been confirmed. Work will be commenced as quickly as possible and pushed with all expedition, so that the entire plant may be in smooth and complete running order before the winter season begins.

Styling an Electric Light Plant a Nuisance.—Mr. Samuel Baugh, an aged and well-known business man of this city, residing at 2,025 Chestnut street, has presented a petition to the county courts, complaining that the plant of the Brush Electric Light Company at No. 2,011 Johnston street, directly in the rear of his residence, is a nuisance, and praying the discontinuance thereof. His citation avows that the hum of the dynamos prevents sleep at night and the vibration of the engines causes walls to crack, dishes to fall from racks and other similar effects. The petition will be presented at the next term of court, and an interesting case is anticipated. Manager De Camp, of the Brush Company, states that the plant was first started in 1881, and while there have been several complaints made and placed in attorneys' hands, yet an investigation by a third party has always resulted in the complaints being dropped. "Some of the reasons for grievance were the most nonsenical you could imagine," said Mr. De Camp, "but I don't know exactly what Mr. Baugh bases his latest complaint upon. At any rate, we are probably in for a trial, and will be ready for it."

The Ball Engine Company, of Erie, Pa., are making considerable additions to their capacity, adding both machinery and new buildings. Although the works have been running night as well as day for the past ten months, the company have hardly been able to keep up with their orders, and the present increase is absolutely necessary. It will give an idea of the demand for this celebrated engine when I mention that the company now have orders for 7,165 h. p. of engines to build for electric light and electric railroad purposes. The thorough manner in which the engines are built, their smooth-running qualities, their handsome appearance and their perfect regulation commend, the Ball engine to electric users. In addition to their regular standard engines, they are now bringing out a line of compound engines, both tandem and double horizontal, in capacity from 30 to 300 h. p. Where condensing water is available, electric light companies cannot afford to use anything but compound engines; and even where condensing water is not available, the saving of fuel will soon pay for the difference in cost The company have just completed the first of twelve 300 h. p. compound engines for the Edison Electric Illuminating Company, of Brooklyn, N. Y., and we learn that the test made at their works was highly satisfactory. The first two engines for this plant will be shipped to Brooklyn in a few days, and when placed on their foundations an exhaustive test will be made.

The Cobb Works, at Wilmington, Del., are one of the interesting sights of that city of factories, and enjoy the distinction of being the busiest works in the whole town. Every machine is running at full speed between whistles, and every man, including the Messrs. Cobb themselves, tries to beat the machinery, the result being that the deep hum of industry is always heard. At present they are working on a contract with the City of Chicago to furnish 100,000 feet of their vulcanite wire for underground purposes, and Manager H. B. Cobb is confident that the order will be greatly increased before the whole consignment is ready. Their present weekly capacity is 25,000 feet of wire covered with their patent flexible vulcanite. The resistance of this covering is abnormally high, and the extreme flexibility of the vulcanite may be judged when a piece of the tubing 8 inches in length can be twisted into a double circle and unbent without any effect being shown upon it. At present the Messrs. Cobb are trying a new method of instantaneously locating faults in new cables. The plan was devised by Mr. Carl Hering before he sailed for Europe, and is being completed by Prof. W. L. Aldrich, of this city, and R. O. Heinrich, the expert connected with the electrical department of J. W. Queen & Co. Under the old arrangements, while the results were infallible, they were somewhat slowly reached, and it is intended to obviate this by using a current of very high potential in the experiments. The plan shows considerable ingenuity apart from its electrical features, and will prove a great success. The Continental Dynamo Company has just sold the Messrs. Cobb a 60-light incandescent machine.

E. F. C.

WESTERN NOTES.

Branch Office of The Electrical World,
39 Mallers Building, Chicago, July 27, 1889.

Grand Forks, North Dakota, desires an electric street railway system.

J. Mukhofer succeeds to the business of Mukhofer, Reuter & Co., electricians, 276 Vine street, Cincinnati.

The Elgin, Ill., Street Railway Systems are considering the advisability of introducing electric power.

Frank E. Fisher has resigned as superintendent of the Detroit Electrical works, to take effect August 1.

St. Louis.—Mr. W. S. Rogers has a company in process of formation to introduce the writing telegraph machines.

Mr. O. R. Cline has relieved Mr. W. J. Robbins of the management of the electric light station at Eldorado, Kan.

A. H. Lewis, manager of the Western office of the C. & C Motor Company, left for New York Wednesday evening.

F. A. Brooks, of the Thomson-Houston Company, is installing 40 arc and 600 alternating incandescent lights at Charleston, Ill.

The Knapp Electrical Works, Chicago, make a specialty of constructing models of electrical apparatus of every character.

The River Forest, Ill., Village Trustees will consider petitions for franchises for electric street railways on Thursday. Aug. 1

The Sperry Electric Company, Chicago, report having sold a 25 arc light plant to Schlesinger & Mayer, dry-goods house, Chicago.

Lane & Bodley are placing two boilers, 72 inches by 16 feet in the station of the Queen City Electric Lighting Company, Cincinnati.

Conant & Hood, Phenix Building, Chicago, are filling orders for the specialties manufactured by the Electric-Dynamic Company, of Philadelphia.

Alexander Kempt, manager of the Chicago office of the Brush Electric Company, returned to the city Friday from a successful business trip.

W. N. Gray, representing the Mather system in Cincinnati, reports more business in isolated plants during the past six months than during all of last year.

C. C. Hatfield, President of the Indianapolis, Ind., District Telegraph Company, has done an extensive business in the house-goods line during the past year.

The National Subway Company have laid and completed ready for drawing in the wires, two and one-quarter miles of ducts of the Dorsett conduit in St. Paul.

The Jenney Electric Company have received orders for 150 arc lamps and apparatus complete from the Central Electric Light and Power Company, Sedalia, Mo.

J. S. Capers, chief dispatcher, L. & N. Railway, has devised and put in operation on the Pontchartrain road a new electric signal system for conductors and engineers.

Mr. B. F. Tracy succeeds Mr. E. E. Campbell as superintendent of the Alton, Ill., Gas and Electric Company, Mr. Campbell having removed to Davenport, Iowa.

James P. McQuaide, of the National Conduit and Manufacturing Company, New York, has finished laying a portion of the Jackson-street conduits for the city lighting plant.

Exhibition of 1892.—Chicago is taking steps to secure the World's Fair in 1892, a committee of 100 prominent citizens being directed to use all proper and honorable efforts to that end.

Mr. James J. Ayer, of the Jenney Electric Company, Indianapolis, still remains at St. Louis superintending the construction of the Municipal Electric Light and Power Company's plant for city lighting.

The Central Electric Company, Chicago, have recently issued a 340-page catalogue containing a full list of all the supplies carried, among which are many novelties appearing now for the first time.

The Edison Villard Illuminating Company has been formed at Milwaukee, Wis.; capital stock, $500,000, divided into 5,000 shares of $1,000 each; incorporators, D. M. Benjamin, Fred M. Finney, Frank G. Bigelow.

James Brunn, assistant in the Electrical Accumulator Company's station at St. Louis, will represent electrical engineering in the Scripps League, Paris Expedition. Mr. Brunn is 26 years old and a native of New Jersey.

Samuel Trawick, of the Excelsior Electric Company, Chicago, secured the contract for a 30 arc light plant complete at Pittsfield, Ill. As it was Mr. Trawick's maiden trip and the competition was strong, congratulations are in order.

The Brush Electric Light and Power Company, Indianapolis, are installing a number of constant current motors to operate large Wing exhaust fans. Both the Brush and the Card motors are in operation on their circuit.

The Electric Traction and Manufacturing Company, New Orleans, have purchased a large cotton warehouse which they will convert into a suitable factory. Maurice J. Hart, manager of the company, is now in New York securing skilled help.

F. A. C. Perrine, electrician of the John A. Roebling's Sons Company, Trenton, N. J., is visiting Chicago in the interests of his company, and will also pay a visit to Mr. S. S. Leonard at Minneapolis, to obtain some data regarding fuel oil and its uses.

The Citizens' Traction Company, Pittsburgh, propose building an electric road from their tracks at Pearl street, near the Penn avenue entrance to the Allegheny Cemetery, through Bloomfield and over to the line of the Fifth Avenue Company at Shadyside.

The Bloomington, Ill., Gas Company's electric light plant is rapidly approaching completion. The Westinghouse system will be used, giving Bloomington the benefit of a third system, the Fort Wayne Jenney and the Thomson-Houston being already in operation.

C. A. Atkins, formerly manager of the telephone exchange at Beatrice, Neb., has assumed charge of the Council Bluffs exchange, relieving Mr. Vance Lane, who was appointed manager of the Omaha exchange. Mr. Lane made many friends during his four years' stay in Council Bluffs.

The National Automatic Fire Alarm Company, of Louisville, have elected the following officers: A. J. Porter, president; Rozel Weissinger, vice-president; Charles Smith, secretary and treasurer; Irwin Dugan, business manager. They have opened suitable quarters in the Tyler building.

The Electrical Supply Company, of Chicago, have opened up a fine trade in the line of instantaneous high tension current double and single pole arc switches. Their portable electric lights are also in demand in all offices and residences where a neat and convenient desk or table light is desired.

The Pond Engineering Company, of St. Louis, have lately sold to the Polar Ice Company, Augusta, Ga., one 103 h. p. Lowe feed-water heater. They are furnishing Mr. John Ring, of St. Louis, with a Blake pump, fitted to pump oil, and the North & Woods Coal Company, of North, Mo., with a Blake tank pump of 100 gallons per minute capacity, for their extensive coal mine.

The New Ulm., Minn., Electric Light Company will have their Brush incandescent plant in operation early in August. The stock of the company is held by twenty of the prominent citizens, who have elected E. C. Pohl, president; C. Silverman, vice-president; Joseph A. Eckstein, secretary; and M. Mullen, treasurer.

Jos. S. Kiehl, Chicago, has secured a patent for and is building a reversible rotary engine having four pistons and developing power with great economy in fuel. Automatic regulation permits of high or low speed. It is designed for train lighting service and can be coupled direct to the shaft of the dynamo or in the ordinary way by belting.

Walter E. Crane, Minneapolis, Minn., has recently issued a neat circular descriptive of the Baker Common Sense oil filter. These filters have recently been placed in the Deaf and Dumb Asylum, Council Bluffs, Ia; the Toledo, O., Electric Company; Magie Bros., Milwaukee; and three by A. W. Ogilvie Milling Company, Montreal, Canada.

Engine Governors.—Judge Blodgett, in the United States Circuit Court at Chicago, July 21, in the case of A. L. Ide, of Springfield, Ill., against the Ball Engine Company, of Erie, Pa., on a bill for infringement of Ide's patent for fly-wheel governors with a dash-pot, held the Ide patent invalid, because it was found that dash-pots had been used in old Buckeye engines.

The Ballou Electric Lighting Company, of Plattsmouth, Neb., O. H. Ballou, president; C. D. Jones, secretary and treasurer, having a capital stock of $30,000, divided into 100 shares of $300 each, are receiving bids for the construction of both arc and incandescent circuits for 10 street arc lamps, 15 commercial arc lamps, and 400 incandescent lamps of the Thomson-Houston system.

Mr. W. J. Clark, of the railway department of the Thomson-Houston Electric Company, has closed the contract for equipping 11 miles of track and placing sixteen 20 h. p. motors on the North End lines in Kansas City; he has also closed the contract for a complete electric railway line across the St. Louis bridge. The Thomson-Houston electric railway lines at Ottawa, Ill., and Richmond, Ind. will be in full operation next week.

The Pumpelly Storage Battery Company, Chicago, have leased from the Fort Wayne Jenney Electric Company the large factory lately erected at Plymouth, Ind., and are fitting it up with every convenience for manufacturing, complete, cells at the rate of 200 per day. This action became necessary when the North American Phonograph Company contracted to purchase of the Pumpelly company every secondary cell required to operate their phonographs.

The Excelsior Electric Company, through Fred W Horne, Chicago, have placed a large number of constant current motors during the month, among the larger sizes being one 10 h. p. motor to operate an hydraulic elevator at E. C. Hanford & Co.'s establishment; and one 10 h. p. motor to operate the shoe machinery at the Waif's Mission. Excelsior motors are also in operation on the Brush circuits in Minneapolis and in Detroit, giving perfect satisfaction in both places.

Pittsburgh, Pa.—A charter has been granted to the Pittsburgh Suburban Street Railroad Company, of Pittsburgh, Pa. The line will be eight and a half miles long, and be operated by electric power. The capital stock is $60,000. The stockholders are: F. G. Kay, Harry McKnight, C. H. Shinkle, James L. Kay, of Allegheny; James Benney, Emsworth, and George M. Brisbin, Osceola Mills. No system has yet been adopted, and the stockholders know that it

will require more than the capital stock of the company to build a line of the proposed length.

Telephone Quotations.—Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes quotations on telephone stocks as follows:

Chicago	$310@$315	Cumberland	$ 69@ $70
Central Union	59@ 60	Wisconsin	117@ 118
Michigan	84@ 85	Bell of Missouri	151@ 153
Great Southern	31@ 33	Iowa Union	23@ 25
Colorado	38@ 40	Missouri and Kansas	63@ 65
Rocky Mountain Bell	41@ 42		

Superior, Wis.—The Superior Arc Light and Power Company has been granted a franchise, and has obtained a contract to light the streets of the city. The officers of the company are the following: A. W. Stow, president; W. B. Kellogg, vice-president; G. D. Moulton, secretary; W. C. Brooks, treasurer; F. R. Anson, general manager. The company will have its plant in operation shortly, and will probably furnish power for the new city railway company.

George F. Card, Cincinnati, has taken the contract for lighting the spectacular display of the Conquest of Mexico, to be given by the Order of Cincinnati during the six weeks beginning Aug. 5. One hundred Sperry arc lights will be used and so placed as to secure the best effect in bringing out the beauty of the scenery, which is fully thirty feet in height. The power is to be furnished by a large factory near by, as it is not considered advisable to install a special steam plant.

The Mountain City Electric Light, Heat and Power Company, Altoona, Pa., have now in operation 750 alternating incandescent lights of the Westinghouse system, and 50 Thomson-Houston arc lights, and have ordered duplicates of both machines in order to keep up with the demand. Three Ball automatic engines furnish the necessary power. This station is in charge of H. Franklin Watts, so favorably known to the readers of THE ELECTRICAL WORLD.

Messrs. A. L. Ide & Co., of Springfield, Ill., have been awarded the contract for two "Ideal" engines for driving an incandescent plant that is being installed in the Odd Fellows' Hall, St. Louis. They have also just installed two Ideal engines in B. Nugent & Bro.'s new dry goods store, St. Louis, and received an order last week from the St. Louis *Republic* for an Ideal engine to light their building. They have also just signed a contract with the St. Louis Bridge and Tunnel Company for a 90 h. p. Ideal engine to drive the generator for operating electric street cars on the St. Louis bridge.

Standard Cables.—Mr. Fred Degenhardt, of Chicago, has secured the following orders for the Standard Underground Cable Company's wires during the past week. Five miles of Standard electric light cable for the city of Chicago; ⅛ mile Standard telephone cable for the Erie Telephone Exchange, Cleveland; 28 miles Standard weatherproof line wire for Sterling, Ill.; ¾ mile of Standard telephone cable for the Chicago Telephone Company, made of sixty-two pairs of No. 18 wire according to the recent specification of the Bell Telephone Company.

The Cincinnati Telephone Exchange suffered severely from the heavy storm of last Thursday, many wires being broken by falling trees, and numerous instruments being disabled by the lightning. The same night Chicago experienced the heaviest rainfall ever recorded there, accompanied by terrific flashes of lightning that burned out many instruments. The morning papers stated that one flash of lightning killed fifty-two sparrows roosting on a telegraph wire. The English bird should have known enough to have gone in when it rained so hard. At Marysville, O., the lightning ruined an armature in the dynamo operating the city lights.

Milwaukee, Wis.—The Edison Company, having decided to establish a central station in Milwaukee, have deposited $500,000 with one of the city banks as an evidence of good faith. The only condition attaching to the company's decision is that there shall be no delay in granting a franchise to lay underground wires in the streets. Their representative, D. Preston Hicks, has arrived in the city to look over the situation and determine whether the project is likely to meet with opposition in the Common Council. It is the purpose of the company to furnish the Edison incandescent light in the city, and also to manufacture dynamos and electric motors.

Prof. J. P. Barrett, Chicago's city electrician, has opened the bids for material for constructing the underground lines for the city electric lighting plant, and has placed an order for 150,000 feet of two-inch iron pipe with Crane Bros., and for 1½ miles of Dorsett conduit with the National Subway Company. Some of the bids opened were as follows: For two-inch iron pipe, plain: Riverside Iron Works, steel pipe, 9.28 cents; National Tube Works, iron pipe, 9.97½; dipped, 10.97½ cents; S. J. Pope & Co., iron pipe, 10.74; dipped, 10.64 cents. Conduits: National Subway Company, one-inch box, 16 cents; two-inch box, 17 cents; manholes, $122.50 each and royalty. National Conduit Company, one-inch box, 19 cents; manholes, $170 each and royalty.

The Patton Motor Manufacturing Company will shortly give an exhibition at Pullman of their motor, which is worked by a combination consisting of a gas engine, a dynamo, and a set of storage cells. The gas to operate the engine is made by the vaporization of gasoline contained in a tank, the amount necessary to generate the current required in operating a train of cars for an hour costing, it is said, eight cents. The engine and also the dynamo are in constant motion, irrespective of the action of the motor, which is controlled by switches and operated by the current from the storage cells. Thus there is always a surplus of current in the cells to meet any emergency, such as drawing an extra trail car or ascending a slippery grade.

The Thomson-Houston Electric Company have sold from their Chicago office during the last few days to the Insane Asylum, Hastings, Neb., a 200 incandescent light plant complete; Ironwood Electric Light Company, Ironwood, Mich., a 1,200-light alternating plant complete; Home Electric Light Company, West Bay City, Mich., 1,000 alternating incandescent plant complete; Electric Light Company, Charleston, Ill., 50 arcs and 650 alternating incandescent plant complete; C. P. Chapman & Co., Pittsfield, Ill., 25-light incandescent plant; Cleburne Electric Light Company, Cleburne, Tex., 300 alternating incandescent plant complete; Capital City Electric Light Company, Des Moines, Ia., 50 arc and 650 alternating incandescent lights; Clinton Woollen Mills, Clinton, Mich., 200 incandescent light plant complete; Denver Illuminating Company, Denver, Colo., two 80 h. p. generators for motor service; Excelsior Electric Company, Port Huron, one 50 h. p. generator for motor service.

Incorporations.—The Steffens Automatic Photographist Company, of Cook County, Ill., to purchase, sell, lease, and operate the Steffens automatic photograph machines; capital stock, $50,000; incorporators, M. J. Steffens, Frank E. Johnson, W. W. Somes, and Walter L. Johnson.

The Elgin Rapid Transit Company, of Elgin, for constructing, maintaining and operating horse and dummy railroads, to be operated by horse, cable, electrical, or any other practical motive power; to furnish, lease, and sell power, light, and heat; to maintain and operate omnibuses and other vehicles for hire, and to buy, sell, lease, and deal in goods, wares, merchandise, and personal property; capital stock, $150,000; incorporators, Howard E. Perry, James McM. Smith, and Azel F. Hatch.

Chicago and Cicero Water, Light and Power Company, of Morton Park, to furnish water, light, and power for domestic manufacturing and all other purposes; capital stock, $50,000; incorporators, Frank Sayre Osborne, M. H. Burgett, and Henry R. Pebbles.

A Primary Battery Plant.—Last fall, Fletcher's Safety Deposit Company, Indianapolis, desiring to use three incandescent lamps in one of their vaults for periods not to exceed fifteen minutes, and being unable to secure service from either isolated plant or central station, or extra power to operate a dynamo, requested Mr. Chas. Reitz to install a primary battery of sufficient capacity to light three Brush-Swan lights of 45 volts, 16 c. p. each. Mr. Reitz called attention to the fact that such an installation would prove neither satisfactory nor economical, and recommended the use of storage batteries, but they were not adopted, owing to the inconvenience of securing current for charging, and for other reasons. So Mr. Reitz prepared twenty-three cells of an improved form of carbon battery, that has given perfect satisfaction during the past nine months. The round glass jars are 12-inch × 8-inch; resting on the top of the jar is a cast brass ring supporting twenty carbons, ⅝-inch in diameter by 12 inches long, and a zinc plate, 12 × 3 × 1 inch, and weighing 9½ pounds, which is suspended in a porous cup containing water slightly acidulated (30 parts water to 1 part sulphuric acid). The solution surrounding the carbons is prepared by adding one and a half pounds of chromic acid to each gallon of water. The cells are cleaned out about once in six weeks. The solution is renewed every three months, and though the battery has been in operation over eight months there is no apparent decrease in the zinc plates.

The Chicago Electric Club is perfecting arrangements for a banquet in dedication of the new quarters, to be given at the club rooms and Kinsley's on the evening of Thursday, Aug. 1. Each member will be entitled to a ticket admitting himself and lady, which will be non-transferable, a limited number of special tickets having been set aside for such guests as members may desire to have present. Plates will be laid for two hundred, and there is every indication of its being a most enjoyable occasion. At a meeting of the Board of Managers on Monday evening ten new application, accompanied by membership fees and six months' advance dues, were received, and the rules suspended and all admitted. The question of holding the regular meeeting of the club on some other night than Monday was taken up and discussed quite fully from all points. Finally it was resolved to issue a circular requesting each member of the club to state what evening is most convenient for him to attend. The following gentlemen were entertained at the rooms during the week: F. A. C. Perrine, Trenton, N. J.; F. B. Platt, Ansonia, Conn.; J. H. Foote, Cincinnati; M. A. Thayer Sparta, Wis.; J. B. Marshall, Topeka, Kan.; Frank Tooker, Bay City, Mich.; W. C. Murdock, New York; G. L. Gray, Fargo, Dak.; M. W. Simonds, Plymouth, Ind.; Carl Kammeyer, Eau Claire, Wis. Additional visitors at the Club rooms were: J. S. House, Springfield, Ill.; R. E. Jenney, C. M. Walls, Cleveland, John E. Alexander, Monmouth, Ill.; W. M. Sandford, New Haven, Conn.

F. DE L.

CINCINNATI, O., July 20, 1889.

Sebastian, May & Co. are about to place a new lathe on the market especially designed for electricians' use.

Mr. Luke Lilly, the electric light inspector for the Underwriters' Association of Cincinnati, has tendered his report of inspections for the last six months, showing 562 buildings equipped with electric lights, comprising 541 arc and 9,172 incandescent; 25 electric motors were also inspected.

The Ætna Machine Company, of Warren, O., lately received an order for one of their engines from Mr. W. I. Slipher, Mulberry, Ind.; also an engine for the Standard Iron Company, Bridgeport, O., and an order for six pipe-threading machines for the Paige Tube Company, of Warren, O.

The Lane & Bodley Co., of this city, have secured the contract for furnishing two 24 in. by 48 in. Corliss engine of 300 h. p. to the Cincinnati Gas Light and Coke Company for their new electric light station; also a contract from the United States Navy Department for one pair of complete condensing Corliss engines, 20 in. by 36 in. by 48 in., with surface condensers and air and circulating pumps, to be installed in the Mare Island Navy Yard, San Francisco, Cal. They are now figuring on a contract in Boston. Should they obtain it they will have a line of Corliss engines across the Continent before the year ends.

Mr. Chas. D. Shain, general district agent for the Westinghouse interests, has opened a handsome set of offices on the ground floor of the Mitchell Building, on Fourth street, in Cincinnati, and is preparing to secure all possible contracts in his territory. During the month he has secured, among other orders, one from the Point Pleasant, W. Va., Electric Light and Power Company for a 500-light Westinghouse alternating incandescent plant, and from the Denison & Urichville Electric Light and Power Company an order for the installation of a complete plant of 1,300 light capacity of the Westinghouse alternating system.

Messrs. C. E. Jones & Bro., of this city, are preparing to move into the large four-story brick building at Nos. 28 to 32 West Court street, where ample space will permit of increased facilities for the transaction of their rapidly growing business, especially their supply department. They are also arranging for the construction of an extensive electric power plant in the basement of the building, having contracted for a 200 h. p. Corliss engine, horizontal tubular boilers, etc. Daft generators will probably be used and current supplied to power users within a radius of eight or ten blocks. Already contracts have been secured for a sufficient amount of power to warrant their duplicating the steam plant.

Natural Gas in Cincinnati.—The Board of Public Affairs of Cincinnati listened on Tuesday to an able argument from General Andrew Hickenlooper against the impracticability of admitting natural gas to the city. The points he made were that gas could not be brought 90 miles and sold at 15 cents per 1,000 feet, and he concluded that the grant is but a cover for a scheme to start an opposition company that would furnish artificial gas for illuminating purposes. Moreover, enough gas could not be brought to the city, which, as estimated on the coal consumed, would require 371,502,000 cubic feet daily, and that would require 155 12-inch pipes. The wells exhaust in from five to fifteen years, and under 300 pounds pressure the pipes are liable to break and suddenly cut off the supply. At 15 cents per 1,000 cubic feet, it is claimed to be nearly three times the cost of coal in Cincinnati, and even in the gas belts the general claimed that people were paying as much for gas as Cincinnatians pay for coal. "If passed, the ordinance would grant the privilege of ripping up nearly 50 miles of newly laid granite and asphalt paved streets, nearly 100 miles of bouldered thoroughfares, and nearly 150 miles of macadamized roadways. It means still more, the cutting across from side to side on all such streets 25,000 trenches at intervals of 25 to 30 feet. It means the shrinkage of $2,000,000 to $3,000,000 in the value of the property of our own citizens' investments, to go into the pockets of a gang of foreign "raiders," and in the end means a doubling up of the capital necessary to perform a single service, and upon which the gas consumers of our city will eventually be called upon to pay dividends, and thus for ever close the doors on cheaper gas." The Board approved of the ordinance admitting natural gas under certain restrictions.

THE TELEGRAPH.

Tampa, Fla.—The Tampa City Council propose putting in a fire alarm system.

The Canadian Cable Company.—It is reported from Ottawa that the British Government has refused to subsidize the new direct Canadian cable. Lord Salisbury states that the idea of granting a subsidy to this new line was to secure direct cable communication between Great Britain and the Dominion, which has been done within the past few weeks by the Anglo-American Company lifting its cable at Newfoundland and splicing it with a new cable into Halifax, by express agreement with the British Government. The Canadian Cable Company will not, however, give up, but asks the Dominion to guarantee half a million dollars of its bonds. Mr. Dobell, projector of the cable, has secured subscriptions in England to the extent of $350,000.

THE TELEPHONE.

The North American Phonograph Company has declared a dividend of 3 per cent., payable Aug. 1.

City of Mexico.—Steps are being taken for the organization of a new telephone company, for the purpose of securing a more satisfactory service.

Atlanta, Ga.—The Georgia Phonograph Company has been incorporated by H. F. Dexter, C. B. Rogers, J. F. Martin and others, of New York. The capital stock is $225,000.

The Pacific Telephone Company, of San Francisco, has been formed with a capital stock of $5,000,000; directors, Lloyd Tevis, W. H. Forbes, George S. Ladd, Evans S. Pillsbury, Samuel Hubbard, W. Flood, W. C. Gibbs.

The Missouri and Kansas Telephone Company has completed connections between Sedalia and Knob Noster, Mo., and by Aug. 1 will have a through line from Kansas City to Sedalia. It will then strike east toward St. Louis.

The Cushman Telephone.—At Chicago, on July 24, Judge Blodgett entered a decree against the Cushman Company and others, granting a perpetual injunction, and the infringing instruments have been surrendered. By agreement, the complainants receive only one dollar damages.

The Sugar Telephone and Telegraph Company has been formed at Kissimmee, Fla., to connect that place by telephone and telegraph with Narcoossee and other points. The incorporators are T. S. Tutwiler, president; J. H. Livingston, secretary, and others, and the capital stock is $15,000.

Augusta, Ga.—The Augusta *Chronicle* states that the local telephone exchange has a new switchboard of 400 subscribers' capacity, and now wired up for 240. Manager D. Murphy is complimented by the paper on the excellence and efficiency of the service. It is stated that the board was built at Charleston, under the supervision of Mr. Easterlin, who has embodied various improvements in it.

THE ELECTRIC LIGHT.

Meridian, Miss.—The Meridian Electric Light Company will enlarge their plant.

Macon, Ga.—Mr. Nussbaum is increasing the capacity of his electric light plant.

Canton, Miss.—The Westinghouse Company will put in a plant for general lighting.

The Brush Electric Light Company has obtained the contract for lighting Griffin, Ga.

Columbia, S. C.—The Congaree Gas and Electric Company will put in an incandescent plant.

Greensboro, N. C.—Mr. W. R. Burgess, agent, wishes to buy dynamo, lamps, etc., for a cotton mill.

Newnan, Ga.—The Newnan Cotton Mills will put in an electric plant. R. D. Cole, Sr., is the proprietor.

Birmingham, Ala.—The Thomson-Houston Company have added a 300 h. p. Corliss engine to their plant.

The Talladega Gas Light and Water Company, of Talladega, Ala., talks of engaging in electric lighting.

Atlantic City, N. J.—Arc lights are at a premium. The local company has been unable to catch up to the demand.

Upton, Mass., and the towns adjoining will soon have a Westinghouse plant, it is said, run by water-power, and costing $50,000.

Sherman, Tex.—The Thomson-Houston Company have taken a city contract for four years. The present plant is to be enlarged.

Flatonia, Tex.—Mr. W. A. Thatcher proposes to put in a small electric light plant, and would like information on the subject, with prices, etc.

Shanghai, China, will receive tenders for electric lighting until Dec. 31, 1889, and the plant selected is to go into operation on April 1, 1891.

Cynthiana, Ky.—The Cynthiana Electric Light & Power Company have received a contract to light the city, and will erect a plant at once.

Meridian, Miss.—The Thomson-Houston Electric Light Company will enlarge their plant and solicit correspondence in regard to machinery.

Grafton, W. Va.—The Baltimore & Ohio Railroad Company will put an electric light plant in their shops, and will probably light the town.

Baltimore, Md.—The Electric Illuminating Company has been formed by W. R. Wales, L. C. Crawford, and others, with a capital stock of $500,000.

Tuscumbia, Ala.—The Tuscumbia Light and Water Company are to add plant for incandescent lighting, and will put in an engine of 100 h. p.

Knoxville, Tenn.—The Schuyler Electric Light Company have bought a site to build a new and larger plant. It is to cost, it is stated, $25,000.

Madison, Ga.—The Gate City Oil Company will light their ginnery by electricity, and have submitted a proposition to the City Council to light the city.

The Central New York Electric Light and Power Company, capital $100,000, has been incorporated, and will operate from Skaneateles, N. Y.

Paris, Ky.—S. Salamon, representing a syndicate, has applied for a franchise to erect an electric light plant and build an electric railway about 1½ miles long.

Pottsville, Pa.—The Edison Illuminating and Power Company, of Pottsville, has organized with H. S. Thompson as president and C. W. Barker as treasurer.

Wytheville, Va.—The city council has decided to put in a Thomson-Houston plant, and is calling for bids on construction, etc. Mr. C.W. Gleaves is Mayor.

The Delavan, Ill., Light and Power Company has been formed by C. W. Kingman, G. H. Lucas, J. W. Hoffman and others, with a capital stock of $10,000.

For Ambulance Work.—The French military authorities are preparing for a series of experiments with electric lamps especially designed for ambulance work.

Atlanta, Ga.—A bill will be introduced in the legislature to incorporate the Atlanta & Chattahoochie Pneumatic & Electric Power and Lighting Company.

Hyde Park, Ill.—The Hyde Park Thomson-Houston Electric Light Company has been formed by B. E. Sunny, M. L. Willard and A. A. Bliss, with a capital stock of $100,000.

Electric Safety Lamps.—A commission has been appointed in Belgium to inquire into the employment of electricity in mines, and particularly as to the use of portable electric lamps.

Baltimore, Md.—Gen. B. T. Johnson has chartered the Westmoreland Company with a capital stock of $250,000, to lay out a new town about a mile from Richmond. An electric light plant will be built.

The Woodstown, N. J., Light, Heat and Power Company, formed recently, will put in a Thomson-Houston plant. The capital stock is $250,000, half paid up. A city contract has been secured.

Mobile, Ala.—The Alabama Gas, Electric Light and Power Company have applied for a franchise to erect gas works and an electric light plant. Their capital stock is $100,000. Gaylord B. Clark is interested.

Wilmington, N. C.—A consolidation has been effected between the Wilmington Gas Light Company and the North Carolina Electric Light & Power Company, and the electric light plant will ibe ncreased and removed to the gas-works.

Wytheville, Va.—The Thomson-Houston Electric Company have contracted to light the city, and will erect an arc and incandescent plant. The Wytheville Electric Power & Improvement Company will furnish power to run the plant.

Fort Payne, Ala.—The Fort Payne Electric Light, Power and Heating Company has been organized, with J. W. Spaulding, president, and A. E. Chapman, secretary. The company will erect a plant with a capacity of about 50 arc and 1,000 incandescent lights.

Another Consolidation.—The United Gas Improvement Company, of Philadelphia, is reported to have secured the controlng interest in the parent Heisler Electric Light Company, of St. Louis, operating the well-known long-distance system of incandescent lighting.

The Bedford Electric Power and Lighting Company has been formed by H. E. Oakley, W. A. Ainsworth, J. H. Mason, V. Smith and H. Leotz, to do a general lighting business in New York State. The capital stock is $50,000, and the offices will be located in Brooklyn.

Long Branch, N. J.—The stock of the Long Branch Electric Light Company, of Long Branch, N. J., has been purchased by the following residents of that place: Rufus Blodgett, D. M. Hildreth, Geo. N. Curtis, H. E. Gawtry and Geo. F. Baker. H. E. Gawtry has been chosen president.

The Central Thomson-Houston Company, of Cincinnati, have just completed a 450-light plant, under the supervision of Mr. Jacobs, in the Eclipse Woollen Mill, of that city. The dynamo is of the new type, and the owners of the mill are delighted with the plant, which has been installed in a thorough manner.

The National Electric Manufacturing Company, organized last Fall, at Eau Claire, Wis., has proven a great thing for that city, says the *Industrial World*, as well as a financial success for the promotors. The company is backed by millionaire lumbermen of that vicinity, and the factory is one of the largest and best equipped in the Northwest.

Florence, Ala.—The Florence Electric Light & Power Company, previously reported as to enlarge their plant, have contracted with the Southern District Telephone, Telegraph & Electric Company for additional machinery and buildings to cost $26,000. A two-story brick and stone building, 60 x 100 feet, will be erected, and a new 85 horse power engine and 120 horse power boiler put in.

Incorporation.—Among the corporations which filed certificates at Albany, N. Y., recently was the Maracaibo Electric Light Company; capital, $100,000. The business of manufacturing gas from coal, kerosene oil, etc., and to light by gas or electricity the city of Maracaibo, or any other city or town in the Republic of Venezuela, is to be carried on. The incorporators are: Francisco Poto Villamizar, Santiago Perez Triana, Rafael Fideau, Albert M. Fuertes, Julio C. Ponce de Leon and Damaso Mazenet, of New York and J. F. Carrillo, of Maracaibo, Venezuela.

Edison Patents in Canada.—A special dispatch from Ottawa of July 24 says: "Argument in the Edison case was heard to-day before the Hon. John Carling, Minister of Agriculture; the Hon. J. A. Chapleau and Sir John Thompson. A rehearing was granted because Mr. Pope, Deputy Commissioner of Patents, who heard the case some time ago, acted without jurisdiction. Mr. Edison seeks to upset the decision which canceled his Canadian patents on incandescent lighting on the ground of his failure to manufacture the patented article in Canada within two years of the issue of the patent."

Cooking by Electricity.—The Hotel Bernina, at Samaden, Spain, has for some time been lighted with electricity, power being supplied by a waterfall. As during the day this power is not required for lighting, and is therefore running to waste, the proprietor of the hotel has hit upon the idea of utilizing the current for cooking when it is not required for lighting, and an experimental cooking apparatus has been constructed. This contains German silver resistance coils, which are brought to a red heat by the current, and it has been found possible to perform all the ordinary cooking operations in a range fitted with a series of such coils.

APPLICATIONS OF POWER.

Savannah, Ga.—The Savannah Belt Railway Company propose to adopt electricity.

Athens, Ga.—The Classic City Street Railway has been sold, and will probably be made an electric road.

Augusta, Ga.—Fleming, Thomas & Co. have bought the Augusta Street Railroad and will operate it electrically.

The Keystone Mining Company, of Amador County, Cal. propose shortly to run their entire works by electricity.

Sioux Falls, S. D.—The Electric Motor Company has been granted a franchise to build a line by the council of that city.

Lewiston, Me.—There is said to be a movement on foot for converting the horse railroad at Lewiston, Me., into an electric road.

Macon, Ga.—George F. Work, of Philadelphia, Pa., has purchased the Macon Street Railway for $75,000, and will, it is stated, operate it by electricity.

Bryson City, N. C.—It is proposed to build an electric railroad from Bryson City to Franklin. B. B. Lake can give information.

Chattanooga, Tenn.—The Chattanooga, Mission Ridge & Chickamauga Railway Company will extend their electric railway about one-half a mile.

Allegheny, Pa.—The North End Electric Passenger Railway Company has been formed by H. Walker, J. Rodgers and others, with a capital stock of $25,000.

Lansingburg, N. Y.—The village trustees at Lansingburg, N. Y., have granted the Troy & Lansingburg Railroad Company a franchise for an electric railway.

Chattanooga, Tenn.—F. P. Henderson, H. P. Durand and others are considering the construction of an electric railway from Chattanooga to Sherman Heights.

Woodstock, Ont.—The Woodstock Electric Light, Power and Street Railway Company has been franchised by the Canadian Government with a capital stock of $50,000.

Portable Hoists for use on docks, wharves, etc., are said to be attracting the attention of the electric motor companies, and some early work of this kind is expected in Boston.

West Indianapolis.—The council of West Indianapolis has invited the local electric light company to experiment with an electric street car line between there and Indianapolis.

Kansas City, Mo.—The East Side Street Railway company has been formed, with a capital stock of $250,000. Mr. W. H. Winants is the president, and Mr. W. B. Knight is the engineer.

Electric Railway for Superior, Wis.—Mr. H. D. Minot, President of the Western Railway, of St. Paul, Minn., has just secured a franchise for a street railway at Superior, Wis., and expects to run it by electricity.

Nashville, Tenn.—The McGavock and Mt. Vernon Street Railway Company, lately mentioned as to extend the use of electricity as a motive power over all their lines, will extend their Spruce street line now operated by horses.

An Electric Transfer Table.—The Fitchburg Railroad Company has contracted with the Westinghouse Electric Company for an electric plant to operate a transfer table and run 200 incandescent lights at its car shops at Fitchburg, Mass.

Waterloo, Ia.—A franchise has been granted by the city council for the operation of the street-car lines in the city by electricity. It is understood that a syndicate of Davenport, Tipton, Cedar Falls and Waterloo capitalists will back the enterprise.

Meriden, Conn.—The Daft road running through this place and now operated by the overhead trolley system is changing its equipment so that the trolleys, instead of running on top of the wires and supported by them, will make contact from below.

The Electric Coal-Mining Machines, manufactured by the Jeffrey Manufacturing Company, of Columbus, Ohio, have proven a complete success, and are now in successful operation in the mines of the Shawnee & Iron Point Coal Company, Shawnee, Ohio.

The Stevens Electric Company, of Birmingham, Ala., have recently bought a complete alternating outfit from the Westinghouse Company. They have also doubled their arc plant of the Waterhouse system. They are now in the market for an electric railway equipment.

Marlborough, Mass.—The Sprague road in operation in this city since the middle of June continues to give entire satisfaction. The overhead trolley system is used, and the conductor consists of silicon bronze wire manufactured by the Aluminum Brass and Bronze Company, of Bridgeport, Conn.

Rochester, N. Y.—Further reports from the new Thomson-Houston road at Rochester show it to be working admirably. The power station has a fine outfit of 250 h. p. from the Woodbury Engine Company, including two handsome high speed automatic Woodbury engines. The road is 4.63 miles long, with length of track 6.20 miles.

Saratoga, N. Y.—Articles of incorporation have been filed by the Saratoga Electric Railway Company. It is proposed to run a surface road at Saratoga to the Kissingen, Geyser and Vichy springs. J. M. Burt, of Bennington; W. B. Ferguson, of Boston, and John L. Butnam, John D. Hayes, Caleb W. Mitchell, George W. Morton, James H. Pardue, and Denman Vail, of Saratoga, are the incorporators. The capital is $50,000.

PERSONALS.

M. L. Woodruff, manager of the Southern District Telegraph and Electric Company, Birmingham, Ala., states that business is in a prosperous condition and the outlook very bright.

Mr. John M. McMahan, who has been connected with various electrical interests in the past, leaves for Europe Aug. 3. Mr. McMahan intends to devote his attention to a number of electrical matters, among them electric railways.

Mr. Fred H. Whipple sends us a list of exhibits already secured for the St. Louis Universal Electrical Exhibition to open on September 4. It fills nearly four closely type-written sheets and includes over 100 leading companies and concerns in the electrical business. The exhibition will undoubtedly be very successful.

MISCELLANEOUS NOTES.

Electrical Execution in France.—A proposal has recently been advanced to abolish the guillotine and substitute death by electricity.

The Chicago, Ill., Electric Battery Company has been formed by F. W. Stewart, H. S. Waldron and G. W. Wylie, with a capital stock of $300,000.

The National Automatic Fire Alarm Company's stockholders held a meeting in Louisville on July 6 for the purpose of organizing and preparing to introduce an improved system of fire alarm in that city.

The "Centralblatt fuer Elektrotechnik," heretofore published three times a month in Munich, in order to keep abreast of the rapid advance of electricity will hereafter appear as a weekly journal. The *Centralblatt* is one of the best German technical publications.

Appomattox Court House, Va.—The Appomattox Land Company have been incorporated with S. S. Burdett, president, and C. G. Beebe, secretary, to deal in real estate and to establish telegraph, telephone and stage lines between Appomattox C. H. and other points. The capital stock is to be $250,000.

The Chicago & Arkansas Railway Construction Company, of Chicago, has been formed for building railway telegraph lines and bridges, and supplying the necessary equipments for the same; capital stock, $325,000; incorporators, George M. Barbour, Adolph Cudell and F. C. Rutan.

Detroit, Mich.—The Standard Electrical Company has filed articles of incorporation, and will sell storage batteries, motors, etc. John E. Wiles, trustee, Detroit, controls 39,995 shares, and John T. Liggett, John E. Wiles, Frank T. Lodge, E. B. Weed and C. A. Klawster own one share each. The paid-up capital is stated at $1,000,000.

An Aid to Pilots.—The increase in the number of electric light plants in towns and cities along both shores of the Hudson River is rapidly making the river at night a brightly illuminated marine highway, and pilots of steamboats of the night lines are well pleased with the situation. When the clouds run high on a cloudy night one can see the reflections from the towns and cities lighted by the electric lights fully 16 miles.

Louisville, Ky.—The committee to whom was referred the question of the feasibility and practicability of removing the telephone, telegraph and electric light wires from certain portions of the streets of the city have reported that they believe that the time has not arrived to take definite action in that city looking to compulsory steps toward placing wires underground, and that it will be for the interest of the city to defer any action for the present.

Names for Electrical Execution.—*American Notes and Queries* has instituted an inquiry among the most eminent scholars of the country to determine the best word to express execution by electricity. The answers as far as received are remarkable for the variety of suggestions. Among them are electrophon, electricize, electrotony, electrophony, thanelectrize, thanatelectrize, thanatelectrisis, electromort, electroctony, electrocta-y, fulmen, electricide, electropcenize, electrothenese, electrocution, electroed, electrostrike, and finally joltacuss or voltacuss.

Birmingham, Eng., Electrical Exhibition.—It is intended to open the Electrical Exhibition at Bingley Hall, Birmingham, on Thursday, Aug. 1. The Lords of the Admiralty have consented to exhibit an extensive series of electrical appliances as used in the navy, including torpedoes, search lights, etc. There will also be an interesting collection of early electrical lighting apparatus now being sent over by Dr. Woodward, of Toronto, Can., among which will be a very early incandescent lamp. All the work in connection with the preparation of the Exhibition is now being pushed on with the utmost possible dispatch.

The Rope Better than Electricity.—A correspondent of the New York *Times* writes as follows: As one of the majority of physicians, who, in response to the inquiries of the Commission on Capital Punishment, preferred hanging to electricity for the administration of the death penalty, permit me to suggest that there is no evidence of pain being caused to the culprit, even when death is not instantly produced by dislocation of the neck; on the contrary, there is reason to believe that the sudden stretching of the spinal cord by the tightened rope causes unconsciousness in every instance, and that strangulation subsequently is unaccompanied by suffering. Convulsive action of the muscles is not indicative of anguish, as is proved in epilepsy and many other disorders, to say nothing of the antics of a decapitated fowl. However repulsive the spectacle of a clumsily-conducted execution may be, my opinion was prompted by the consideration that the most bungling hangman would not be likely to do as much ante-mortem harm to his victim as an inexpert electrician might inflict. The most certain, and probably the most merciful instrument of legal homicide is the guillotine, but since sentimental objections might prevent its adoption in this country (as also in the case of the garrote), hanging seems to be next in the matter of humanity.

BUSINESS NOTICES.

All Electricians who *are using* or *have used* Schieren's electric perforated belts say that they "take the cake" for running on dynamos.

The Wainwright Manufacturing Company, of Massachusetts, have recently supplied their well-known corrugated copper tube feed-water heaters to the Nyack (N. Y.) Electric Light Company to the extent of 200 h. p.

Perforated Belts run *smoother*, with *less* strain on *dynamo bearings*, and with the use of *less oil* than any other belts made. They also *prevent air cushions*. Chas. A. Schieren & Co. (Manufacturers), New York, Chicago, Boston, Philadelphia.

Battery Cut-Out.—Attention is called to a simple device for disconnecting gas-lighting batteries if accidentally grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company, of Syracuse, N. Y., No. 105 South Warren street.

Patterson, Gottfried & Hunter, 146-150 Centre street, 111-115 Walker street, carry a complete stock of brass and iron machine and wood screws, cap and set screws, all kinds of bolts, taps, files, twist drills, brass and rubber tubing, brush copper, rod and sheet copper, brass rods, sheet German silver, sheet brass, machinery, tools, hardware, etc, Electric motor supplies.

The Lord Boiler Compound is already as well known in electric light stations as it is in other older departments of industry, and it is nowhere better liked. Mr. G. W. Lord, the inventor, of 316 Union street, Philadelphia, states that over 30,000 establishments in this country are using the compound, and that many of the larger ones literally order it by the ton. The desirability of a good boiler cleaner is so evident that one need not wonder to find Lord's compound so popular. It can be cordially recommended to electric light men.

THE GIBSON ELECTRIC COMPANY, No. 74 Cortlandt Street,
New York City, May 27, 1889.

The Elektron Manufacturing Company, cor. Jay and Plymouth Streets, Brooklyn, N. Y.:

GENTLEMEN: Your communication asking for information as to efficiency of electric motors sold to us in the past two years received.

It gives me pleasure to write that I have tried and thoroughly tested every make of motor put on the market, starting with the first, and unhesitatingly state over my signature that the Perret Electric Motor has given the highest efficiency of any tested, and not only high efficiency, but the mechanical work and finish, in my judgment, is the best, insuring durability of wearing parts, also noiseless when in motion. Yours very truly,

(Signed), CHAS. D. P. GIBSON,
Vice-President and General Manager.

Owing to the pressure on our columns, the Patent Record has been omitted this week.